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12-13 July 2023

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AGHAM AT TEKNOLOHIYA PARA SA DEMOKRASYA

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Host Division: Social Sciences Division

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ASD-01

AGRO-MORPHOLOGICAL PERFORMANCE OF SELECTED PIGMENTED RICE GENOTYPES

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Pigmented rice is a type of special purpose rice which appears in various intensity of pigmentation (purple, red, black), rich in anthocyanins and proven effective in curing wide arrays of diseases. Its nutraceutical properties and high price in the market, the demand is increasing in both domestic and international market. Ten advanced pigmented rice lines identified promising CLH 476-1A, CLH 476-1B, CLH 476-10, CLH 496-17, CLH 463-15, CLH 463-17, CLH 453-1, CLH 453-4, CLH 453-17, CLH 606-4 were evaluated along with check varieties, Pirurutong and PSB RC 19 for yield and other agronomic traits. Evaluation was done in WS and DS using the Randomized Complete block design (RCBD) with three replications. Data were analyzed using the IRRI STAR software and means were compared using HSD at 5% level of probability. Results revealed significant variations among genotypes with respect to all agromic traits considered. Most of the lines had early maturity which ranged 101-108 days after sowing (DAS) which was significantly earlier than Pirurutong (111 DAS) and PSB Rc 19 115 (DAS), but did not differ during DS. Shorter plant height was exhibited by CLH 453-17 (74-105 cm) 105 cm) and CLH 453-4 (93-107 cm). which were different from PSB Rc 19 (120 cm) during WS but did not vary during DS. The number of productive tillers was comparable between lines and the checks across season (8-14). Most of the lines had panicle length which ranged from 22.23-27.30 cm during WS and 19.84-25.61 cm during DS which were comparable with PSB Rc 19, 26.35 (WS)-24.71 cm (DS). Five of the lines produced significantly more filled grains (138-165) than Pirurutong (92) while all the lines were comparable with PSB Rc 19 in both seasons. The heaviest 1000 seed weight was recorded from CLH 463-15 in both seasons (31 g) which was different with Pirurutong and PSB Rc 19 in both seasons 29 and 22.33 g (WS) and 22.33 and -26.67 (DS), respectively. The lines produced yield which ranged from 4.43-6.49 t/ha with CLH 463-15, the highest which was significantly different from the check, Pirurutong (4.57 t/ha). Likewise, CLH 463-17 produced yield of 5.71 t/ha which outyieded Pirurutong by 24.95%. The lines need to be evaluated for grain quality.

Keywords: pigmented rice, agronomic traits

ASD-02

ASSESSMENT OF SOIL EROSION AND STABLE ISOTOPE SIGNATURES OF FIVE DOMINANT LAND USE TYPES IN TALUGTUG, NUEVA ECIJA, A SUB-WATERSHED OF MANILA BAY

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Soil erosion from the different sub-watersheds of Manila Bay contributes to the bay's pollution, due to sedimentation (Rojales, et al. 2017). But the information on the magnitude of soil erosion on specific land use is limited. To help fill in this gap, the magnitude soil erosion (soil loss) from five dominant land use types in Talugtug Nueva Ecija (a sub-watershed of Manila Bay) will be assessed and their respective stable isotope signatures will be measured.

Sediment traps were established in five dominant land use types (forest, grassland, cultivated area with soil and water conservation, mango orchard, and cultivated area without soil and water conservation) in Talugtug, Nueva Ecija (a sub-watershed of Manila Bay). Runoff water and sediment samples were collected monthly in 2018 and 2019 to measure the amount of soil erosion/soil loss per land use type. Surface soil samples have been collected from five dominant land use types and carbon and nitrogen stable isotopes have been determined using an isotope ratio mass spectrometer.

Highest annual soil loss was obtained from grass land at 15.36 tons/ha, followed by mango orchard (7.37 tons/ha). However, annual soil loss from cultivated land with soil and water conservation measure (widely spaced single line fruit tree seedlings with trash line and vegetative barrier), forest and cultivated lands gave no significant differences, having been measured at only 2 to 3 tons/ha. The carbon stable isotope ($\delta^{13}C$) values reflect the vegetation cover (C3 plants) of the different land use types (with the exception of grassland area). The nitrogen stable isotope ($\delta^{15}N$) values could be due to the kind/type of fertilizer being used in the area.

Grassland greatly contributed to the soil erosion process in Talugtug, Nueva Ecija followed by mango orchard. On the other hand, annual soil loss from cultivated land with soil and water conservation measure, forest and cultivated lands gave no significant differences. The stable carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) isotope signatures have been used as soil erosion indicators in five land use types in Talugtug, Nueva Ecija. The vegetation cover of the study sites and the type of fertilizer being used could help explain the observed stable isotope values.

Keywords: soil erosion, stable isotopes, Talugtug, Nueva Ecija, Manila Bay sub-watershed

ASD-03

EARLY ROOTING RESPONSES OF VARIOUS CUTTINGS OF *Bambusa blumeana* (SCHULT. & SCHULT.F.) TO DIFFERENT ROOTING HORMONES AND MISTING SYSTEMS

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A nursery trial was conducted to determine the best combination of cutting, rooting hormone, and misting system for rooting *Bambusa blumeana* Schult. & Schult.f. bamboo species. Six types of cuttings were used including 2-node culm, 2-node culm with open internode (2 cm x 1 cm opening), 2-node split-halve culm, 1-node primary branch base, 1-node primary branch middle, and 1-node primary branch top. The cuttings were dipped into 100 ppm rooting hormones (i.e., NAA, IAA, IBA and distilled water as control) for 24 hours except for 2-node culms with opening in which the rooting hormones were poured into the hole. The misting systems used were mist and non-mist systems. A split-split plot design was used in the study with the type of misting systems as the main factor, rooting hormones as subplot factor, and cuttings as sub-subplot factor. The treatments were replicated five times. Measurements of the number of roots and root length per cutting were made 50 days after the experiment establishment. Higher number of roots was observed only from 2-node culm, 2-node culm with open internode, and from the combination of non-mist and culm cuttings (2-node culm, 2-node culm with open internode). Root length, on the other hand, responded positively from NAA and IBA rooting hormones with the three culm treatments (2-node culm, 2-node culm with open internode, split-halve culm) were observed to have longer roots. The combination of IBA and culm with open internode also yielded longer root length compared to other treatments. Overall, this early rooting responses of *B. blumeana* indicate that culms cuttings (specially culm with open internode) treated with 100 ppm IBA under a non-mist system can be recommended to initiate higher and longer root system for mass clonal propagation of *B. blumeana*.

Keywords: Rooting performance, cuttings type, rooting hormones, misting system, *Bambusa blumeana,*

ASD-04

EFFECTS OF BIOCHAR-MYCORRHIZAL FERTILIZER AMENDMENT ON CACAO (*Theobroma cacao*) AND COFFEE (*Coffea* spp.) IN AGROFOREST ECOSYSTEMS IN LAGUNA AND BATANGAS

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The world demand for cocoa and coffee beans and corresponding cacao- and coffee-related products has been increasing since the previous years. Despite the advantageous geography and climactic conditions, Philippine cacao and coffee growers still encounter problems and issues in promoting growth and improving tree crop production. With that, this study investigated the effects of a novel biochar-biofertilizer-vermicompost formulation on the rhizosphere soil microbial community (mycorrhiza and nitrogen fixers) and the growth of mature *T. cacao* and *Coffea* sp. trees. The cacao farms were in Liliw, Laguna (Site 1) and Magdalena, Laguna (Site 2) while the coffee farms were from Sta. Maria, Laguna (Site 3) and Lipa, Batangas (Site 4). Trees under study were amended with MYKORICH® (MR) without or with 15% bamboo biochar (15% BB) and vermicompost. Results of the three-year experiment showed that the growth of MR-treated cacao trees in Site 1 were 35% higher than the uninoculated trees, whereas the growth of BB-treated trees in Site 2 were 5% higher relative to the control. For the coffee trees, MR+BB treatment consistently gave a highly significant effect in growth relative to control in both Site 3 and 4 (17% and 36% higher than control, respectively). Soil microbial analysis showed that mycorrhizal spore counts in cacao farms were higher in BB-amended soils while in Site 3, MR-treated trees had 151% higher spore count than control. Coffee trees inoculated with MR+BB in Site 4 had the highest spore count (30% higher than control). Nitrogen-fixing bacteria obtained from MR+BB-amended soils in Site 1 were 216% higher than control. In Site 3, the population of nitrogen fixers was highest from MR+BB trees (232 % higher than control) and bacterial count from MR-treated plots in Site 4 was 103% higher than the uninoculated plots. In terms of soil quality, soil nitrogen and potassium contents of the cacao and coffee farms also improved. Compared to initial measurements, soil N contents of cacao farms were ~25-85% higher than the initial N content while soil K contents were ~50-60% higher than the K content measured before the inoculation of biofertilizers. In the coffee farms, increase in soil N contents ranged from 9-70% and an increase of ~80% to more than 100% in soil K content was also observed. With the significant effect of bamboo biochar and biofertilizer, alone or in combination, on the growth of cacao and coffee trees, the microbial community and nutrient status of the cacao and coffee rhizosphere soils, this technology would be beneficial to cacao and coffee farmers and almost all crops in the Philippines.

Keywords: bamboo biochar; cacao; coffee; mycorrhizal fungi; nitrogen-fixing bacteria

ASD-05

GALL RUST DISEASE INCIDENCE AND SEVERITY IN A FALCATA (*Falcataria moluccana* (MIQ.) BARNEBY & J.W.GRIMES) PLANTATION GROWN FROM SELECT MOTHER TREES IN MINDANAO, PHILIPPINES

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This study aimed to determine the availability of gall rust resistant seed sources of Falcata (*Falcataria moluccana*) in the region and investigate the impact of gall rust infection on the growth of the trees. A trial was conducted with 130 mother trees as treatments and four replicates and was assessed five years after establishment in 2015. The results showed significant variation in the mean percent incidence ($15.0 \pm 5.0\%$ to $80.0 \pm 14.1\%$) and severity ($3.75 \pm 1.25\%$ to $35.0 \pm 16.95\%$) of gall rust among the treatments, indicating genetic diversity among the mother trees. The incidence of gall rust ranged from occasional to widespread, while the severity ranged from low to high. Mother trees collected from Mutia, Zamboanga del Norte (tree 99) and Magsaysay, Baliangao, Misamis Occidental (tree 106) were identified as the most resistant. The study found that height and diameter were positively related to gall rust incidence and treatments, although mother trees with resistant traits did not show superior growth. The study also revealed an indication of a trade-off between growth and disease tolerance, where trees with higher gall rust incidence tended to grow bigger, possibly to compensate for negative impacts from gall rust infection. This study provides valuable baseline data for future progeny selection of gall rust resistant clones of Falcata in the region and highlights the need for further research to identify the most resistant seed sources and understand the trade-off between growth and disease tolerance in Falcata.

Keywords: *Falcataria moluccana*, gall rust, incidence, severity, resistant clones

GROWTH-PROMOTING POTENTIAL OF NATIVE MYCORRHIZAL ISOLATES ON THREE NATIVE LESSER-KNOWN SPECIES

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Rehabilitation of mined-out areas entails greater costs and challenges. The use of naturally occurring bioremediation species promotes biodiversity conservation. This study explored the effectiveness of native mycorrhizal isolates from a Copper-mined out area in promoting the growth of the locally available containerized *Myristica philippensis, Syzygium* sp., and *Madhuca betis* on a Nickel- and Copper-laden substrate. An experiment was conducted in Randomized Complete Block Design (RCBD) with five blocks and 10 seedlings per treatment. A total of 750 vigorous seedlings of 4-mo old *M. philippensis* and 2-mo old *Syzygium* sp and *M. betis* of almost uniform size on 6" x 4" black polybags with mixtures of unsterilized soil, chicken dung, rice hull, and vermicompost (1:1:1, v/v) were selected. Inoculation of commercial biofertilizers was done at a rate of 5 g per seedling with BioN™, MYKORICH®, or its combination, and with Nmyc, a potential biofertilizer containing new mycorrhizal strains. After a month, seedlings were balled and exposed to heavy metals by transplanting them into 9" x 12" polybags with 2 kg mine soil. Treatments had significantly *(p<0.05 – p<0.0001)* promoted the growth, leaf area and biomass of all species after 303 days of inoculation, except for the leaf biomass *(p= 0.0546)* of *M. betis*. Height growth of all species was excellent with the new mycorrhizal isolates, while its diameter growth was comparable or far better than those with the commercial inoculants in most cases. Leaf count of *M. philippensis* and *Syzygium* sp. with Nmyc was significantly lower than those inoculated with commercial inoculants, but Nmyc gave the widest diameter in *M. betis*. The effect of Nmyc to LAI of *M. philippensis* and *Syzygium* sp. was comparable with the commercial ones but much lower in the case of *M. betis* with Nmyc. BioN effected the greatest leaf blade expansion in *M. philippensis*, while MRICH in *Syzygium* sp. and *M. betis*. Nmyc effected a comparable increase in root biomass with the commercial inoculants in *M. philippensis* and *M. betis*; for *Syzygium* sp., MRICH and MRICH+BioN gave the highest, while Nmyc was comparable with BioN. Nmyc effected a comparable increase in leaf biomass in *M. philippensis* with MRICH+BioN, and with BioN and MRICH+BioN on *M. betis*. In *Syzygium* sp., MRICH alone had the highest leaf biomass, while Nmyc was comparable with the rest of the treatments. Stem biomass of *M. philippensis* with Nmyc was significantly the highest, but in *M. betis*, its effect was comparable with MRICH alone. For *Syzygium* sp., MRICH and MRICH+BioN had higher effect than the rest of the treatments. The effect of Nmyc could match with the commercial ones. However, its efficacy must be tested further in other plant species in other mining areas in the Philippines since other species can have different responses and relationships with microbial consortia.

Keywords: mycorrhizal isolates, lesser-known, inoculant, microbial consortia

ASD-07

IDENTIFICATION OF PLANT GROWTH-PROMOTING BACTERIA AS POTENTIAL ENHANCER FOR DROUGHT TOLERANCE IN UPLAND RICE

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Drought is a major constraint in agricultural crop production that causes low average yield of upland rice. Here, 75 potential isolates were screened for their growth-promoting activities to evaluate the effectiveness of rhizospheric bacteria on the growth and ability to enhance drought tolerance of upland rice. Among the seventy-five isolates, only eleven resulted positive in starch hydrolysis, twenty-five for phosphorus solubilization and sixty for 1-aminocyclopropane-1-carboxylate (ACC) deaminase activity. Indole-3-acetic acid (IAA) production and ACC deaminase activity served as the basis in selecting five potential plant growth-promoting bacteria (PGPB). The selected isolates were isolates 53, 54, 59, 87, and 124 which were evaluated for drought tolerance using PEG assay at varying level of concentration (15%, 25% and 35%). In this study, inoculation with bacterial isolates 53, 54, 59, 87 and 124 significantly increased shoot length of seedlings at 15% and 35% PEG at 7 DAS. At 14 DAS, shoot length, fresh weight of rice seedlings, and dry matter percentage increased at 15% PEG, 25% PEG, and at 35% PEG, respectively. However, at 15% and 35% PEG no significant differences in fresh weight was recorded but was able to observed a percentage increase of up to 16.38% and 39.58% increase, respectively. At 35% PEG, leaf rolling and tip burning were not observed in seedling inoculated with bacterial isolates 87 and 59. Improvement of up to 25% observation in drought tolerance also contributes to the conclusion that plant growth-promoting bacteria can be a promising approach to control drought stress. However, re-evaluation of the selected isolates for drought tolerance at seedling stage is recommended to validate previous results and field assessment to determine the effect of biotic and abiotic stresses.

Keywords: indole-3-acetic acid, 1-aminocyclopropane carboxylic acid, phosphate solubilization, polyethylene glycol, plant growth-promoting bacteria

ASD-08

INFLUENCE OF STORAGE DURATION AND COMBINATIONS OF SEED SIZE AND HYDRO-PRIMING ON THE GERMINATION AND EARLY GROWTH PERFORMANCE OF *Aquilaria cumingiana* (Decne) Ridl.

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Aquilaria cumingiana (Decne) Ridl. is one of the identified tree species under Agarwood plants, possessing recalcitrant seeds in a short period of viability. It is known in many Asian countries to have a resinous heartwood that occurs in trees. It belongs to recalcitrant seeds that shed at high water contents and metabolically active shedding and are desiccation sensitive, thus, seed germination and early growth of this species are critical and more vulnerable in the nursery. Germination and seedling vigor are greatly affected by seed storage duration, seed size, and pre-germination. The study was conducted to investigate the influence of seed storage duration, seed size, and hydro-priming on seed water uptake, germination, and subsequent seedling vigor of *A. cumingiana*. This study was laid out in a completely randomized design (CRD) in a factorial experiment with four (4) storage duration set-ups and six (6) treatments used. Among the different set-ups used were seed storage duration (4) with different levels of treatments, the seed size (2 levels) x hydro-priming (3 levels). A total of 2600 seeds in five replications were used. Seeds were classified into large seeds (above 0.1349 gram) and small seeds (below 0.1300 gram). Four groups of seeds were stored for 0 days (control or no storage), 14 days, 21 days, and 28 days. After the seed storage duration, seeds underwent hydro-priming treatment at different time duration (12 hours, 24 hours, and control). Significant differences were found in the seed mass weight and water uptake by the seeds for the no seed storage (0.1348 $\pm$ 0.0158 grams) and 28 days of seeds storage (18.7 $\pm$ 4.7%), respectively, compared to other levels of treatment. *A. cumingiana* seeds with no seed storage had the highest germination rate with 80.3 $\pm$ 15.6% and drastically reduced to 10.0 $\pm$ 10.9 % when seeds were stored for 14 days while no germination occurred from 21 to 28 days storage duration. Under the no seed storage set-up, large size seeds treated with 12 hours of hydro-priming significantly had the highest germination rate with 98.0 $\pm$ 4.5% compared to the other treatments, except for the unprimed large size seeds with 96.0 $\pm$ 4.2%. Furthermore, significant differences among treatments were observed in the seedling vigor index I and II under the no seed storage set-up. It was observed that large size seeds treated with 12 hours of hydro-priming produced vigorous seedlings (seedling vigor index I- 16.09 $\pm$ 2.20 and seedling vigor index II- 0.1619 $\pm$ 0.0560). To enhance and optimize the germination percentage and produce vigorous seedlings of *A. cumingiana* seeds, it is recommended to use the non-stored large-size seeds treated with 12 hours of hydro-priming.

Keywords: *Aquilaria cumingiana* (Decne) Ridl*., seed storage, seed germination

ASD-09

INTEGRATED ANALYSIS OF CASSAVA PRODUCTIVITY IN DIFFERENT AGROECOSYSTEMS IN THE CALABARZON

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The rising cassava industry in the country is one opportunity that can be taken advantage of to enhance small farm productivity. The CALABARZON is dominated by small farmers in different agroecosystems like rice-based, corn-based, sugarcane-based, coconut +vegetables in upland and rolling areas or are fisherfolks. Cassava was a mere border crop or the traditional "plant and forget' crop but now is a crop of interest integrated into these agroecosystems as alternate or intercrop. This paper is an attempt to investigate cassava production thereby determine critical factors that affect its productivity in these agroecosystems. The study was conducted through a formal survey of nearly 300 farmers who have integrated cassava in their farming systems. Results were evaluated based on 4 major criteria: Productivity or cassava production and agronomic practices that contribute or constrain tuber yield; Profitability or net income obtained from Cassava and other related factors that contribute or constrain income from cassava; Stability of production or the natural disturbances including pests and diseases; and Sustained production which are other factors (biophysical, socio-cultural, extension support) that enhance or deter continuous production. Twenty-four variables are used where each variable is assigned threshold values and rated using the Likert scale. Graphical presentation of the results and analysis was done using the radar graph. Results showed that cassava farming practices, distribution and marketing vary in these the agroecosystems. The average fresh tuber yields ranged from 3.5 to 8.5 T/Ha, 86 to 96% of which are sold. Agronomic yield did not necessarily translate into economic productivity due to other biophysical and social factors. In sugarcane-based Agroecosystem, cassava production is dependent on the anticipated market price for sugarcane where the latter is the priority crop. Proximity to animal feed mills opened-up market opportunity in the upland rolling agroecosystems though not on a regular basis. Many but not all cassava farmers in Laguna and Quezon are benefited by vegetable trading where fresh cassava tubers are included as a vegetable commodity. A major factor that discouraged cassava farmers in many agroecosystems is the non-appearance of wholesale buyers at harvest time. While institutional support to production like quality planting materials, production technology, non-formal education and farmer-training on enhancing crop yields, farmers are still on their own in marketing their produce. Market determines continuity of small-holder production of cassava in the agroecosystems studied. As the country aims to increase cassava production at the national level and reduce importation of cassava, small-holder contribution to national production can be optimized and farmer inclusivity in the cassava industry can be enhanced if there is thorough investigation and understanding of cassava farming in these agroecosystems and interventions provided are specific to each agroecosystem.

Keywords: cassava, agroecosystem, CALABARZON

ASD-10

LEVERAGING PREEXISTING EXOTIC *Piper aduncum* L. VEGETATION AS A NURSE PLANT TO RESTORE SUCCESSIONAL GRASSLANDS IN MINDANAO, PHILIPPINES

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We propose that using restoration planting in conjunction with nurse plants is the most effective strategy for restoring forests in harsh habitats. However, in the absence of native nurse plants, colonizing exotic vegetation in degraded successional grasslands can potentially be used as nurse species in restoration projects, as long as they do not outcompete or suppress the target native plants beneath their canopy. In this study, three manipulative planting techniques were tested within a successional grassland dominated by invasive exotic *Piper aduncum* L. (Piperaceae) species. The treatments were: understory planting (planting under the canopy of *P. aduncum*), canopy edge planting (planting at the dripline of the *P. aduncum canopy*), and open site planting (planting in open grassland sites). We used three canopy species from the Dipterocarpaceae family for restoration, including *Shorea polysperma* (Blanco) Merr., *Shorea ovata* Dyer ex Brandis, and *Parashorea malaanonan* (Blanco) Merr. Seven seedlings per species were planted individually in each treatment and replicated in six locations within the area, for a total of 63 plots. The treatments differed significantly in terms of canopy openness and light conditions. There were no significant variations among Dipterocarp species in growth performance independent of the treatments. However, independent of species, seedlings grew significantly better at the canopy edge sites, which had moderate light canopy openness compared to understory and open sites. The seedlings' growth performance (i.e., relative height growth, relative diameter growth, and biomass density) and survival were positively associated with moderate light levels, particularly between 0.8 to 1.2 mol m^{-2} d^{-1}, which correspond to the light conditions at the edge sites. Furthermore, the seedlings at the edge sites generated a higher number of new leaves than at the other treatments, although seedlings planted beneath the canopy of *P. aduncum* had bigger leaf areas, likely a natural response to lower light conditions at this treatment compared to edge and open sites. Nonetheless, this study demonstrates that preexisting invasive exotic *P. aduncum* can be managed to act as nurse plants to facilitate the establishment of canopy species in harsh and degraded habitats such as successional grasslands.

Keywords: *Piper aduncum* L. (Piperaceae), plant habitats, forest restoration

ASD-11

NUTRIENT UTILIZATION EFFICIENCY AND ANTIOXIDANT PROFILE OF BC2 ABACA (*Musa textilis* nee) HYBRIDS

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Nutrient use efficiency in abaca production has never been considered in previous studies and could have practical relevance to fiber yield productivity, fertilizer use, and cropping management systems. A pioneering study was carried out to evaluate the N, P_2O_5, and K_2O uptake and utilization efficiency, as well as the antioxidant profile of BC2 abaca (*Musa textilis* Nee) hybrids in relation to fiber synthesis and quality characteristics. The NPK contents of fiber tissue were quantified using standard colorimetric approach and atomic absorption spectrophotometer (AAS). Young leaf samples were also collected from the trial for the analysis of the antioxidant profiles of different abaca genotypes. Results showed that the traditional variety accumulated more NPK in fiber tissue than the BC2 abaca hybrids. Increased NPK uptake is associated with higher yield nutrient concentrations but lower nutrient efficiency ratio and utilization efficiency in abaca production. In comparison to nitrogen and phosphorus, significant proportions of K_2O element were observed across genotypes. The BC2-2 and BC2-7 abaca hybrids had significantly higher P_2O_5- and K_2O-nutrient utilization efficiency and antioxidant contents than the check variety, which requires more NPK uptake per unit yield. Peculiar antioxidant profile among abaca genotypes had also been observed which may suggest its potential involvement in adaptation, fiber synthesis and quality attributes.

Keywords: nutrient use efficiency, nutrient efficiency ratio, BC2 hybrids, antioxidant profiles

ASD-12

DROUGHT RESISTANCE CAPACITIES AND PHYSIOLOGICAL RESPONSES OF MUNG BEAN (*Vigna radiata* L.) NSIC Mg 14

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Mung bean is considered as a drought tolerant crop. However, this claim is not fully determined under lowland rice field conditions. The study was conducted to determine the physiological characteristics, growth response and yield capacity of mung bean NSIC Mg 14 under drought condition. The different treatments evaluated were normal watering (NW) condition (Control plant 1), which is watered regularly; drought condition (D) (Control plant 2), which does not receive water after emergence; and five (5) transient waterlogged-to-drought (W-D) conditions as the other treatments which includes 75% Soil Moisture Capacity (SMC), 50% SMC, 25% SMC, 10% SMC, and 5% SMC maintained until harvest. Gathered data were analyzed using Analysis of variance (ANOVA) for Completely Randomized Design (CRD) with the used of Statistical Tool for Agricultural Research (STAR) software, and Comparison Among Means (CAM) was done with Tukey's Honesty Significant (THS) Test. Results showed that among all treatments, 75% SMC has significant effect to control plant 1 and it could be concluded that a 75% SMC maintained at a mung bean plant had produced positive results in terms of yield, growth, and physiology while drought conditions negatively affect the overall development of mung beans even though they are known to be drought tolerant. As a recommendation, the SMC level to be applied in Mung bean should always be higher than 50% in order to obtain a yield that is nearly the same as or significant to those supplied with 100% SMC. Similar related field experimentation is recommended in order to validate and make production and management of Mung bean profitable even under drought stress conditions.

Keywords: drought, growth response, physiological characteristics, SMC, yield capacity

ASD-13

REDUCTIVE REMOVAL OF HEAVY METALS IN MINE-CONTAMINATED SOIL WITH COCONUT HUSK AND CATTLE MANURE BIOCHARS

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The prevalence of environmental issues on waste management and heavy metals (HMs) has caused increasing public concerns, with the magnitude and complexity on soil pollution. The production of biochar through slow pyrolysis is a farm-based, value-added approach to recycle organic waste. Cattle manure (CM) and coconut husk (CH) were slowly pyrolyzed under temperatures ranging from 300°C to 650°C using a biochar-producing stove. Two studies were conducted to examine the effects of biochar on the concentration of HMs when applied in marginal soil (*Typic Eutrudepts*) collected from a mine-polluted rice environment. Rice was used as the test crop. The morphological characteristics and physicochemical properties of biochars were studied using the Brunauer-Emmett-Teller Automated Nitrogen Multilayer Physisorption system, Field Emission-Transmission Electron Microscopy and X-ray Energy Dispersive Spectrometry. Chemical properties of soil and plant tissues were also examined. Results showed that the addition of biochars to mine-contaminated soil reduced the concentrations of HMs (Cu, Fe and Zn). Under lowland rice water condition, CM and CH biochars significantly reduced the Fe level from 486 ppm to 79.6ppm and 78.1ppm, respectively, and the former significantly reduced Zn level from 153 ppm to 2.83ppm. Under upland water condition, both biochars decreased the amount Cu from 390.0ppm to 3.5ppm; and Fe level from 486ppm to 54ppm. The amount of Cu, Fe, Mn and Zn in plant tissues (leaves, roots and grains) were at low level under both rice water conditions. The HMs adsorption capacity for biochars maybe associated to high surface area of the CM and CH biochars with 68.04 m^2/g and 107.19 m^2/g, respectively. The biochars' compositional and crystallographic images also substantiated their adsorptive properties. Such findings confirmed that biochar is a promising material for facilitating the remediation of heavy metal-polluted soils.

Keywords: waste management, biochar, pyrolysis, soil amendment, heavy metals

ASD-14

RELATIONSHIP OF ALIM (*Melanolepis multiglandulosa* (REINW. EX BLUME) RCHB. & ZOLL.) TREE TRAITS AND ITS CHLOROPHYLL CONTENT TO THE SELECTED VEGETATION CHARACTERISTICS

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Alim (*Melanolepis multiglandulosa*) is a small tree that is abundantly growing in a wide range of sites. T[...] assess its potential as indicator species, leaf chlorophyll content was correlated with selected seedling and sit[...] variables. Chlorophyll content was taken in five fully expanded leaves of sample seedlings within 20 m x 20 [...] plots. Only a few significant correlations were observed between chlorophyll content and seedling traits. Heigh[...] Stem Diameter Ratio correlated strongly with chlorophyll content. Correlation between chlorophyll content an[...] vegetation characteristics, and among vegetation characteristics were observed. Only a few relationships came ou[...] to be significant having coefficient values of -0.5016 to 0.8970. Among the site characteristics, canopy closure an[...] crown depth were strongly and very strongly correlated with chlorophyll content. The study showed potential f[...] chlorophyll content of alim seedlings as an alternative to the actual assessment of forest understory condition tha[...] is affected by canopy closure and canopy depth.

Keyword: chlorophyll content, Alim (*Melanolepis multiglandulosa*)

ASD-15

SELECTION OF NICKEL TOLERANT NATIVE TREE SPECIES FOR REHABILITATION OF NICKEL MINED-OUT AREAS IN THE PHILIPPINES

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Nickel (Ni) is considered as a micronutrient and is essential to survival of plant due to its role for nitrogen metabolism, however, if in higher concentration can lead to serious health risks. The use of plants as the technology to extract elements from the soil is a sustainable way to deal with low to average Ni-contaminated soils that can potentially address this issue. Thus, this study aimed to test microbial biofertilizers such as arbuscular mycorrhizal fungi and nitrogen-fixing bacteria to determine its effect on plant growth of Narra, Mangium, and Bagalunga when applied with Ni in these concentrations: 0, 6, and 12 mg kg^{-1}/soil. The seedlings were inoculated with the commercial biofertilizers from the National Institute of Molecular Biology and Biotechnology, University of the Philippines, Los Baños (BIOTECH-UPLB) – MYKORICH and MYKOCAP and fertilizers isolated from Marinduque Cu-mine tailing site (coded as NMYC and NNFB) and were raised under the screenhouse in BIOTECH-UPLB. Six months after inoculation, MYKORICH exhibited the highest height increment in Narra and Bagalunga in soil with 6 and 12 mg of Ni, respectively, while NMYC promoted the highest height in Mangium seedlings under Ni-12. In terms of stem diameter increment, MYKORICH gave the highest value in Mangium and Bagalunga experiment, both in Ni-6 soil, while MYKOCAP in Narra grown in Ni-12 soil. In terms of total plant biomass, all three species showed different results. MYKOCAP gave the highest total plant biomass in Narra grown in Ni-12, while NMYC and MYKORICH established the highest value in Mangium and Bagalunga, respectively, when grown under soil with 6 mg of Ni. Microbial analysis was also conducted, and the results showed that mycorrhizal spores in MYKORICH thrived in Narra and Bagalunga seedlings while MYKOCAP in Mangium, all under Ni-6. MYKORICH inoculated seedlings also infected the roots of Narra with a high percent rate of colonization at 56% in Ni-6, while MYKOCAP treatment provided the highest infection in Mangium and Bagalunga with 44% and 50.5%, respectively, under soil with 12 mg of Ni. These responses can provide useful basis in selecting plants for restoration purposes in other Ni mine sites but further studies should be conducted specifically in conducting soil and plant tissue nutrient analysis to verify the results in this study.

Keywords: arbuscular mycorrhizal fungi, nitrogen-fixing bacteria, nickel, plant growth

ASD-16

INTEGRATED SOCIAL-ECOLOGICAL ASSESSMENT OF A PHILIPPINE TRADITIONAL UPLAND RICE AGROECOSYSTEM IN SOUTHERN PHILIPPINES

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The Sarangani traditional upland agroecosystem in Southern Philippines is presently at the nexus of agricultural modernization, bio-cultural erosion, and environmental degradation. Upland farms in these areas are inhabited predominantly by smallholder tribal households who cultivate rice landraces (RLs) using traditional farming methods. Using the social-ecological system (SES) approach, this study investigated Sarangani SES components and connections and feedbacks that underlie their interactions. Combined Driver-Pressure-State-Impact-Response (DPSIR) and causal chain analysis (CCA) captured the complexity of the Sarangani SES, revealed its key features, and outlined prevalent issues/suggested responses to pressing problems. Furthermore, the study identified drivers of change in this SES and pointed out aspects that had been grossly oversimplified, leading to potential biases and lapses in policy and management decisions. Also unveiled by the study were bio-cultural losses, declining health/well-being of farmers, environmental degradation, and weak institutional support as major challenges to the resiliency of the Sarangani SES. For the Sarangani situation, interventions that uphold human welfare while conserving tribal culture/resources and preserving the environment are therefore warranted. The SES approach, coupled with the combined use of DPSIR and CCA, shows promise as an effective decision-making tool and thereby gives instituted interventions better chances of success.

Key words: social-ecological systems, DPSIR, causal chain analysis, Sarangani, traditional agroecosystem

ASD-17

SOIL MESO-MACROFAUNA DIVERSITY AND POPULATION AS AN INDICATOR OF SOIL HEALTH:A QUALITATIVE INVESTIGATION

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Soil animal diversity is one of the indicators in assessing soil health and their contribution is recognized in enhancing soil functions and properties of the soil. This study is aimed to assess the diversity and population of soil meso-macrofauna under the organic and conventional farming systems on its contribution in the improvement of soil health. Considered as biological indicators, soil organisms in different trophic group and farms namely: Mangatarem, Pangasinan; Lucban, Quezon; Liliw-Nagcarlan District; and Talisay, Negros Occidental were investigated. Activities of different groups of these organisms in relation to decomposition of organic materials into organic matter and into nutrients that plants can use for growth; improvement of soil porosity; and soil fertility were considered. Results showed that the diversity and population of soil animals (mites, termites, silver fish, grubs, ants, spider, maggots, millipedes, ringworm, and earthworms) are affected by impacts of different soil management practices which may greatly influence the productivity of the soil. It was observed that earthworms were the dominant soil animals found in organic farming system while ants and termites were the dominant ones in conventional farming system. Moreover, diversification of crops; application of soil cover; and effective use of fertilizers and pesticides are recommended to improve soil meso-macrofauna diversity and population.

Keywords: mesofauna, macrofauna, organic farming system, conventional farming system

ASD-18

QOI FUNGICIDE RESISTANCE AMONG *Colletotrichum* SPP. ISOLATED FROM ANTHRACNOSE INFECTED 'CARABAO' MANGOES

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Colletotrichum spp. is a fungal plant pathogen widely known to cause anthracnose to Carabao mango. Being the most cultivated and famous variety in the Philippines, anthracnose management is the top priority of many local Carabao mango producers. Oftentimes, management of this disease involve the routine application of QoI fungicides in the field, including of which is azoxystrobin. However, many reports have associated the extensive use of fungicides to cause the rise of fungicide resistant *Colletotrichum* strains. Thus, this study performed QoI fungicide screening assays to detect *Colletotrichum* resistant strains isolated from anthracnose infected mangoes originating from different regions of the country. This was done by cultivating *Colletotrichum* isolates in potato dextrose agar (PDA) amended with azoxystrobin (100µg/mL), and SHAM (100µg/mL), a reagent that shuts down the alternative respiration pathway of the fungi, for 7 days. After the screening, no isolates with high azoxystrobin resistance (Inhibition rate = ≤30%) were detected. However, the moderately resistant isolates (Inhibition rate = 30-90%) detected were six *C. tropicale* isolates, one *C. fruticola* isolate, one *C. gloeosporioides*, and one *Colletotrichum* spp. isolate. On the other hand, only one *C. theobromicola* and one *Colletotrichum* sp. isolate was detected to be azoxystrobin sensitive (Inhibition rate = ≥90%). The detection of moderately resistant of *Colletotrichum* resistant isolates is indeed alarming as it may indicate that the efficacy of azoxystrobin is deteriorating.

Keywords: fungicide screening, *Colletotrichum* sp., fungicide resistance, QoI fungicide.

ASD-19

COFFEE SPECIES SUITABILITY AND PREFERENCE OF THE PRIMARY COFFEE PEST Hypothenemus hampei (Ferrari) (*Colcoptera: curculionidae*) UNDER LABORATORY CONDITIONS

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Coffee farming in the Province of Cavite is grown in a multiple cropping system. Cultivation of more than one coffee species with varied timing of phenological stages may attract potential pests that may impact production. This study compared coffee species (*Coffea canepora, C. excelsa, and C. liberica*) suitability and infestation preference of *Hypothenemus hampei* under laboratory conditions.

A free – choice test and life history experiment was conducted. Preference was determined by introducing adult *H. hampei* females of approximate ages in a circular plastic container with a dimension of 24 cm x 9 cm, lined with an illustration board and divided into three chambers that served as search arena. Ten berries of each BBCH Scale category (BBCH 79, BBCH 81-85, and BBCH 88) makes up the 30 berry samples for each of the coffee species. For the life history experiment, *H. hampei* individuals were reared in *C. canephora*, *C. excelsa,* and *C. liberica* ripe beans to assess their suitability to support its development and survival.

Free-choice test revealed that colonizing *H. hampei* females preferred *C. canephora* berries with the highest infestation rate of 40.78%. Majority (91.64%) of the colonizing females reached the CD position where, they have penetrated the endosperm, created galleries, and oviposited 11.15 eggs and developed 5.53 larvae - on the average after 10 days of infestation. Regardless of coffee species, the colonizing females favored berries that were more matured and on the ripening stages specifically BBCH 88. Life history experiment showed that *H. hampei* in *C. canephora* beans had the shortest total developmental period, from egg to larva, pupa, and adult (25.55 days), longest adult male longevity (38.92 days) and 70.57 days for females, and the highest total fecundity of 61.05 eggs. In contrast, the longest total developmental period (29.15 days) and lowest female fecundity (55.95 eggs) was recorded in *C. liberica*. Proximate analysis of the coffee berries from the three coffee species revealed that C. canephora has significantly higher moisture, ash, fiber, protein, fat, and carbohydrates. With these findings, *C. canephora* is the most preferred and suitable coffee species for *H. hampei* development.

INTEGRATED WEED STRATEGIES FOR DIRECT-SEEDED AND TRANSPLANTED PIGMENTED RICE

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The study aimed to determine the effects of different weed strategies and planting method in the growth and yield performance of pigmented rice. Four weed strategies as main plot were applied namely W1-stale seedbed technique, W2 – stale seedbed + pre-emergence herbicide, W3 - stale seedbed + pre-emergence herbicide + water management and W4 - stale seedbed + pre-emergence herbicide + water management + post-emergence herbicide while planting method as sub-plot (direct seeding and transplanting) were evaluated.

Weed damage is one of the major factors contributing to the low yield of rice farming. Here are the seven common weeds of pigmented rice observed in the experimental area. These were *Sphenoclea zeylanica, Ludwigia hyssopifolia, Ischaemum rugosum, Echinochloa colona, Echinochloa glabrescens, Fimbristylis miliacea and Cyperus iria*. In terms of agronomic performance, plant height was significantly influenced by weed strategies and planting method but not with their interactions. The W2, W3 and W4 significantly produced taller plants (121.cm, 125 cm and 124.8cm) while only W3 and W4 got the highest productive tillers (207 and 283). Longer panicles (25.5 cm), highest number of grains (189), grain yield (3 tons/ha) and harvest index (0.44) were observed in W4. Interaction did not show any significant results on weed strategies and planting methods except for the productive tillers. Transplanted rice (128.8 cm) produced taller plants, longer panicles (25.2 cm), higher number of grains (172) and higher yielder (2.1 tons/ha) but had less productive tillers than direct seeded rice. With the highest yield of W4, income also increased when sold as dehulled rice (₱44,392.7) as compared to when sold as seeds (₱40,547.9).

Keywords: weed, pigmented rice, direct-seeded, transplanting

ASD-21

ISOTHERMAL AMPLIFICATION-BASED BIOSENSOR FOR EARLY-WARNING INTERVENTION AGAINST RICE BLAST

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As the advent of modern rice cultivation practices significantly improves, the crop is still heavily impacted by rice diseases, such as Rice Blast, in the onslaught that threatens global food security. Worldwide, the destruction caused by these fungal pathogens can cause a 5 - 80% reduction in rice grain yield or 0.23 - 1.37 tons per ha. Seeds and propagating resources of rice plants can also be the primary source of the pathogens that cause various diseases. Positioning the Central Luzon State University at the heart of agriculture in the Philippines, has ventured into several engagements in improving rice production. A modified isothermal amplification-based biosensor was developed to determine the presence of these pathogens. The isothermal amplification-based biosensor was used for rice blast in seeds, storage, and warehouse swabs. The device was improved for dry format Loop-Mediated Isothermal Amplification (LAMP) technique, which provides precise results for detecting pathogens compared with conventional methods. The formulated assay was tested on-station using different varieties of rice and seed storage swabs for repeatability, sensitivity, and specificity analyses. The formulated assay was specific as tested against other related fungi and sensitive and detected even crudely extracted DNA down to 40.8×10^{-6} ng/µL or 40.8 femtograms. The device serves as a decision tool for stakeholders to discard rice seeds or provide phytosanitary treatment before storage, seed banking, and quarantine.

Keywords: biosensor; dry format, isothermal amplification-based, rice blast

ASD-22

LABORATORY BIOEFFICACY OF THE POWDER FORMULATIONS OF ENTOMOPATHOGENIC FUNGUS, *Metarhizium rileyi*, AGAINST ONION ARMYWORM

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A beneficial fungus, *Metarhizium rileyi* (Farlow) Kepler, S.A. Rehner and Humber, is a native entomopathogen that incites lethal effect to a major insect pest of onion such as the armyworm, *Spodoptera exigua* (Hubner) (Lepidoptera: Noctuidae). This fungus caused high infection particularly to resulting neonates of treated eggs and larval instars of onion armyworm under laboratory conditions. With its potential as a biological control agent, this study aimed to prepare powder formulations of *M. rileyi* and assess their efficacy against onion armyworm. Dry conidia of the fungus were mixed with various powder carriers including talc, kaolin clay, diatomaceous earth, and sodium carbonate. Laboratory test was conducted to compare the effect of powder carriers and *M. rileyi* mixed with various powder carriers to the 3rd larval instar of onion armyworm. The larvae were fed with castor leaves sprayed with the treatments. All the treated larvae succumbed to 1×10^7 conidia/ml of *M. rileyi* alone and powder formulations while the powder carriers caused only 20 to 52% mortality. Mean lethal time to larval death was generally lower in powder formulations of *M. rileyi* than *M. rileyi* alone and various powders. These findings suggest the additional control benefit of formulating *M. rileyi*. Continuous development of this biopesticide is necessary for it to be integrated in the onion armyworm management program.

Keywords: biological control, mummification, biopesticide, wettable powder, formulation

MOLECULAR BIOSENSORS FOR EARLY DETECTION OF SOIL AND WATERBORNE PATHOGENS OF ONIONS: A PREVENTIVE BASIS FOR DISEASE MANAGEMENT

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Onion is one of the most profitable high-value crops, however, it is easily infected with pests and diseases resulting in huge income loss to the farmers. The volume of onion production reached its peak with 203 thousand metric tons during the year 2014 but then the volume dropped to a considerable amount of 122 thousand metric tons in the year 2016. These plant diseases and pests often threaten the safety of plants for production. Plant pathogens are very similar to those that cause disease in humans and animals such as fungi, fungal-like organisms, bacteria, phytoplasmas, viruses, viroid, nematodes, and parasitic higher plants are all plant pathogens.

This research endeavors to detect suspected onion pathogens identified in the top onion-producing municipalities of Nueva Ecija which includes the Science City of Muñoz, Bongabon, Sto. Domingo, Rizal, Guimba, Nueva Ecija, using the collected soil, irrigation waters, and plants applying the improved and different molecular detection platforms in parallel with the conventional isolation and culture methods. Also, to conduct validation with the morphological characterization of fungal pathogens through microscopy analyses and determine the efficiency in terms of analytical sensitivity, specificity, and repeatability of the formulated assays. The top three major diseases involve the Onion Twister Disease or Anthracnose-Twister, or Seven Curl Disease caused by *Colletotrichum gloeosporioides-Gibberella moniliformis* disease complex; the Purple Blotch disease of onion caused by *Alternaria porri*; and the Damping-Off caused by *Rhizoctonia, Fusarium and Phytophthora* and soil fungus *Pythium*.

Parallel testing and comparing the conventional isolation and culture, Polymerase Chain Reaction, Loop-Mediated Isothermal Amplification (LAMP), and an improved isothermal amplification-based tool through assessing the positivity rates, the conventional method has 33.3%, PCR with 41.7%, the LAMP and the improved biosensor have 65.7%. In other cases, these molecular techniques detected the presence of the target pathogens even when they were not observed in the conventional method. The results also indicate that the sensitivity of the LAMP and the improved biosensor was shown more sensitive than that of the PCR assay. The analytical specificity of the DNA markers with the target pathogens showed positive results against the non-target species. Meanwhile, based on the soil analysis results, soil pH in Rizal and Munoz has the lowest pH with a pH of 5.8, which, to some extent, corresponded with the relatively highest incidence of detected pathogens. LAMP combined with RPA, the lower-cost molecular techniques than PCR has proven to be confirmatory tests of the target pathogens present in plants, soil, and irrigation water which recommends an advancement for the comprehensive field surveillance-response approach in many developing countries with resource-limited settings for early detection and contributing to the control and early disease management.

Keywords: onion twister disease, anthracnose-twister, seven curl disease

ASD-24

MOLECULAR IDENTIFICATION OF *Plesiomonas shigelloides* ISOLATED FROM CAGE CULTURED TILAPIA (*Oreochromis niloticus*)

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The high density and intense aquaculture business have suffered significant financial losses as a result of several bacterial infections, but the pathogenic mechanism behind the broad problems brought on by numerous bacteria is still unknown. In the present study, we isolated a bacterial strain from *Oreochromis niloticus* having a typical bacterial disease *P. shigelloides*. Affected fish showed gill pallor, discoloration, fin rot, bilateral exophthalmia, ascites, and hepatosplenomegaly. This study aimed to identify bacterial pathogens associated with *P. shigelloides* in cage-cultured tilapia. A total of ten (10) apparently healthy tilapia were sampled for bacterial isolation and identification. Morphological and biochemical tests showed the agent causing bacterial infection belongs to the genus *Plesiomonas.* Bacterial isolates were recovered from the gill, liver, spleen, kidney, and brain of the samples. Molecular identification by 16s rRNA and sequence analysis using NCBI-BLAST showed 99.69% similarity to *Plesiomonas shigelloides*.

Keywords: *Oreochromis niloticus*, tilapia, *Plesiomonas shigelloides*

ASD-25

PREPARATION, HOMOGENEITY, AND STABILITY ASSESSMENT OF A REFERENCE MATERIAL FOR ACCURATE DETERMINATION OF CYPERMETHRIN RESIDUE IN MANGO

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Mango is a primary fruit crop in the Philippines due to its great demand in local and international trades. However, a pressing concern in mango fruit production is the persistent use of pesticides, such as cypermethrin. When administered at high concentrations, pesticides are known to cause adverse effects on human health. Thus, a reliable analytical method for quantifying pesticide residues in agricultural products is necessary to ensure food safety, consumer protection, and regulatory compliance. The maximum residue limit (MRL) established for cypermethrin in mango is 0.03 mg/kg. An essential tool for providing the quality of chemical measurements is the use of a reference material (RM). In this study, Philippine Reference Material (PRM) 1901 Cypermethrin in Mango was prepared and assessed in terms of homogeneity and stability in accordance with ISO Guide 35:2017. The candidate material, previously freeze-dried and fortified with cypermethin, was homogenized and bottled into individual units. Quantification of cypermethin was done using a validated technique employing a Quick, Easy, Cheap, Effective, Rugged, and Safe (QuEChERS) extraction method and gas chromatography with an electron capture detector (GC-ECD). Linear regression and Cochran's Test showed the absence of bottling trend and outliers, respectively. The prepared RM was sufficiently homogeneous based on analysis of variance (ANOVA) and the uncertainty from between-bottle homogeneity (u_{bb}) is 1.93 %. A short-term stability study using regression analysis also proved that the RM was stable for transport at 4 °C during the entire study period (three weeks). The developed RM has a very promising application in quality control, method validation, and method performance assessment of local chemical testing laboratories to be compliant with ISO/IEC 17025:2017 accreditation.

Keywords: reference material, cypermethrin, pesticides, gas chromatography, QuEChERS

ASD-26

SILENT SOURCE OF BBTV: FIRST EVIDENCE OF SEED TRANSMISSION AND NEW ALTERNATE HOST

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Naturally-infected alternate hosts of BBTV exist in the wild indicating that there is an active inoculum source of the virus in the area. In the presence of insect vectors, sources of inoculum may facilitate the uncontrolled spread of BBTV. The search for potential alternate hosts was done to identify sources of BBTV inoculum. The banana growing areas in the provinces of Laguna, Batangas, Cavite, Isabela, Quirino (Luzon), Cebu, Bohol, (Visayas) Davao de Oro, Davao del Norte, and Davao del Sur (Mindanao) were explored. The commonly encountered plant species intercropped with banana include *Xanthosoma sagittifolium* L. (San Fernando Gabi), *Heliconia* sp. (Yellow heliconia), and *Colocosia esculenta* (Gabi). Other observed plants are *Alocasia* sp., *Canna indica,* (Golden canna), *Curcuma longa,* and *Hedychium coronarium* (Camia). Only San Fernando Gabi was consistently positive to BBTV in six provinces. In Laguna, *Canna indica* plants as well as its seeds were observed to harbor BBTV. Evidence of seed transmission in *C. indica* was supported by grow-out test and transmission assay. Eleven out of 32 germinated seedlings of *C. indica* tested positive for BBTV. Transmission assay using *C. indica*-infected seedling as virus source revealed that inoculated susceptible banana varieties like 'Lakatan' can exhibit the BBTV characteristic symptoms at 2 months post-inoculation. *Canna indica* is a known host of BBTV but this is the first evidence of transmission of BBTV from seeds of infected plants. Infected seeds are considered the most efficient dispersing agents of pathogens as they cause great damage. Likewise, alternate hosts like San Fernando Gabi aid in the survival and spread of the virus for the next cropping cycle. The results of the study are advantageous to the mitigation efforts of the Philippines against BBTV.

Keywords: Seed, Transmission, *Canna indica*, San Fernando gabi, banana bunchy top disease

ASD-27

SURVEY, CHARACTERIZATION, AND GENETIC DIVERSITY OF ROOT KNOT NEMATODES ATTACKING VEGETABLE CROPS

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Meloidogyne species (RKN) causing root knot disease are one of the most important nematode pathogens in tropics because of their wide host range (vegetables, fruit-crops, and ornamental), broad distribution and destructiveness that have significant economic impact. RKN are known not only to reduce yields but also lower the quality of the produce. Vegetable farms in the provinces of Cavite, Laguna, Batangas, Rizal, and Quezon were surveyed for the presence of root knot nematodes. The RKN incidence in the surveyed sites ranged from 0 to 13 percent of the plants examined. A set of standard test cultivars (tomato, eggplant, pole sitao, okra, tobacco, peanut, and banana) were used as differential hosts for the pathogenicity tests. Results showed that tomato, okra, banana and sitao were highly susceptible to the different RKN populations tested. Tobacco had mostly moderate reaction while peanut had 0 to low reaction rating to most of the nematode populations. Morphometric analysis of 10 individuals from each population revealed very low variation with all measurements agreeing with the reference *M. incognita* type specimen used. Although there are some minimal mean differences in some characters, the ranges revealed that most of the measurements are contained in these ranges. ITS-rDNA and mt-COI genes were amplified by PCR and sequenced for molecular analysis of the different RKN populations. Sequence analysis of the amplicons from each of the populations confirmed the identity of the isolates as *M. incognita* with 99-100% similarity from those *M. incognita* in the GenBank database. The use of mt-COI marker showed no variation among the populations, while the ITS exhibited very small nucleotide differences, indicating low genetic diversity among the different populations of RKN. Moreover, the small geographic distance, and possible similar lineage might have also contributed to this apparent low molecular variation. This research bridged the gap using molecular techniques available to accurately identify and study the genetic diversity and distribution of RKN in vegetable farms in the CALABARZON region of Philippines.

Keywords: *Meloidogyne* spp., root knot nematode, genetic diversity, ITS-rDNA, mt-CO1

ASD-28

RAPID DETECTION KIT FOR *Aeromonas hydrophila* INFECTING NILE TILAPIA USING GOLD NANOPARTICLE-BASED DNA PROBE

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A major problem worldwide is the emergence of aquatic pathogens, such as *Aeromonas hydrophila*, that are widely distributed in the environment. Thus, accurate and rapid identification of the causative agent is important for the treatment and control of fish diseases. In this study, a laboratory-based rapid detection kit for *A. hydrophila* was developed using colloidal gold nanoparticle-based DNA probe. A series of trials, modifications and optimizations was done to fully optimize the rapid detection protocol for *A. hydrophila*. The detection kit can detect the target pathogen, without obtaining false positive and false negative results, at a minimum detectable limit of 5±1.0 ng/µL and a maximum detectable limit of 139±6.08 ng/uL. Two modified protocols (1 and 2) in the detection of *A. hydrophila* were produced from the Detection Protocol A. The modified protocol 2 which was simplified by removing some steps which led to a faster detection time at a reduced cost compared to the standard protocol and modified protocol 1. Modified detection protocol 2 for *A. hydrophila* had 100% sensitivity and 90% specificity. The developed kit can be stored up to one month at room temperature without affecting its sensitivity and specificity. In conclusion, the developed rapid detection kit using simplified protocol is user-friendly and can be used to detect *A. hydrophila that* is affecting tilapia industry.

Keywords: *Aeromonas hydrophila*, gold nanoparticles, rapid detection kit, DNA probe

ASD-29

ANTIOXIDANT AND ANTI-DIABETIC PROPERTIES OF OKARA AND THE *IN-VIVO* CHOLESTEROL-LOWERING POTENTIAL OF THE FORMULATED OKARA SOYSAGE

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Okara is the primary byproduct generated by the soymilk and tofu industry. The increasing global production of soybean products generates tons of okara each year and this presents a huge waste disposal problem. Previous studies have demonstrated that okara can effectively be used to formulate low-fat processed meat products. This research investigates the *in vitro* antioxidant and alpha-glucosidase inhibitory properties of okara flour, followed by *in vivo* effects of formulated okara soysage in the blood HDL and glucose levels of female Sprague-Dawley rats. Findings revealed that okara flour has a total phenolic content of 0.08 ± 0.00 mg/gallic acid equivalent (GAE), and exhibits DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging activity of 365.76 ± 12.50 µmol/trolox equivalent, and Ferric Reducing Antioxidant Power (FRAP) of 95.69 ± 3.00 µmol/trolox equivalent. Aqueous extracts of okara flour, at all concentrations tested (125 µg/mL- 1000 µg/mL), significantly ($p = >0.05$) inhibited α-glucosidase activity *in vitro*. *In vivo* animal study showed that feeding okara soysages for 28 days does not significantly affect their weights ($p = >0.05$). *In vivo* blood chemical analysis on the rats displayed an increase in High Density Lipoprotein level in the High Fat + 20% okara soysage-fed group suggesting the potential cholesterol-lowering effect of okara soysage if taken for extended periods of time. Moreover, unlike the Basic Diet + 20% Pork sausage, High-Fat diet, and High-Fat diet + 20% Pork sausage fed groups, a combination of okara with a basic or high-fat diet does not cause an evident alteration in the glucose level, which could be attributed to okara's high dietary fiber content. Gross necropsy results support the claim that the okara is non-toxic and safe for consumption. Overall, findings suggest that okara is a promising ingredient for plant-based sausages with potential health promoting effects.

Keywords: okara, soysage, cholesterol-lowering, antioxidant, antihyperglycemic

ASD-30

DEVELOPMENT AND ACCEPTABILITY OF VEGETABLES PROTEIN ENRICHED FUNCTIONAL FOOD PRODUCT FROM SPECIAL PURPOSE RICE

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Covid 19 pandemic created problems of difficulty in accessing nutritious food. In response, developing functional food products from different aromatic rice variants such as pigmented and brown rice will help ease the problem of availability of nutritious food during period of emergency. The project aimed to a) develop two variants of cereal bar as functional food product from special purpose rice enriched with vegetable protein; b) evaluate the products in terms of physico-chemical characteristics, proximate, microbial, and nutrient; and c. determine the consumer's acceptability. Two variants of nutribars were produced, the nutty and fruity bars. The nutty bar was enriched with peanuts and cashew nuts while the fruity bar with dried mangoes. Additional food ingredients were added such as sesame seeds, malungay and saluyot as source of vegetable protein. The products were evaluated to determine their physicochemical contents, proximate, microbial and nutrient analysis. The products have low water content and pH vale of <5.0. Proximate analysis showed significant amounts of crude fat and crude protein attributed to plant based protein sources. Moreover, based on nutrient analysis, the bars are packed with energy as well as essential nutrients such as carbohydrates, protein, mineral and fiber. In view of these nutrient contents, they can be considered healthy food options during pandemic and other forms of emergencies, and are very convenient food while traveling. Moreover, the products the products had low water content and passed the aflatoxin and microbial analyses indicating they are safe for human consumption. Both nutty and fruity bars were acceptable to the consumers. They had indicated their purchase intention favorably.

Keywords: pigmented rice, cereal bar, vegetable protein enriched, functional food

ASD-31

IN VITRO GLYCEMIC INDEX OF COOKED BROWN RICE OF SOME INBRED VARIETIES IN THE PHILIPPINES

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Brown rice (BR), or unpolished rice, has the potential to lower blood glucose response and consequently reduce the risk for type 2 diabetes. However, its usually harder cooked rice texture than milled, or white, rice poses a major obstacle to its widespread acceptability among Filipinos. Selecting a specific rice variety with acceptable texture based on eating quality indicators, particularly amylose content (AC) and gelatinization temperature (GT), is therefore needed for BR production. This study evaluated the *in vitro* glycemic index (GI) scores of unpolished forms of eight Philippine-released inbred rice varieties representative of clusters of milled rice (MR) with different AC and GT combinations. The four MR clusters were previously generated using Hierarchical and K-means cluster analysis of the apparent AC and GT of 102 milled rice varieties, released by the National Seed Industry Council from 1992 to 2018. BR samples were prepared following the protocol of the National Cooperative Testing Project for Rice. Their cooked rice texture profiles were measured using an Instron ® hardness machine and the *in vitro* GI scores were determined based on a modified resistant starch assay described in AOAC Official Method 2002.02 and AACC Method 32-40.01. Results showed that BR form of NSIC Rc 17, a waxy/glutinous variety belonging to Cluster 1, was the only sample classified as high-GI. This means that it can raise the blood glucose level immediately after ingestion, which is typical of MR forms of varieties under this cluster. However, NSIC Rc 31 BR, which is also a Cluster 1 variety, recorded a moderate *in vitro* GI, indicating a lower potential to cause a spike in blood glucose level. BR samples under Clusters 2-4 also had moderate *in vitro* GI scores (60.5-69.3). These samples had a soft cooked rice texture, which is preferred by the majority of Filipinos. NSIC Rc 302 and PSB Rc 18 of Cluster 2 (low to high AC, intermediate to high-intermediate GT) had the lowest *in vitro* GI scores (60.5-61.8). Thus, among the samples tested, the BR forms of these varieties could best deliver the health benefits needed by those controlling their blood sugar levels without compromising their eating quality. For the continual quest for rice with health-promoting properties, testing of other clustered varieties is recommended.

Keywords: amylose content, brown rice, gelatinization temperature, glycemic index, rice clusters

ASD-32

RECOVERY OF HEAT FROM CARBONIZER ATTACHMENTS FOR UTILIZATION IN FOOD PROCESSING

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Carbonized rice hull (CRH) is very useful in crop production especially in soil conditioning. In the process of producing CRH, heat is generated but it just dissipates and gets wasted. To recover and utilize the heat, cubical- and cylindrical-type ovens were designed and developed as carbonizer attachments. To evaluate their suitability and efficiency in food processing, the cubical-type oven was tested for drying fish while the cylindrical-type oven was utilized in roasting chicken. Prior to drying, the *tilapia* samples were cleaned and washed thoroughly. The samples were then sliced as *daing* cut and dipped in 0, 25, 50, and 75% for 1-2sec. Although 25% was found to be the most acceptable in terms of saltiness based on sensory evaluation, the concentration was further adjusted to 20% to reduce the saltiness. The fish samples were placed in the oven equipped with internal temperature monitor. Meanwhile, medium-sized chickens were marinated and roasted using the cylindrical-type oven. The oven temperature (top and bottom), chicken internal temperatures, and total cooking time were observed. Finally, quality evaluation of both the fish and chicken samples was conducted. The drying of tilapia took 4h with oven temperature ranging 102-119°C. Based on sensory evaluation, the quality of the tilapia dipped in 20% brine solution had significantly better overall inside and outside appearance, color intensity of left interior, crispness, overall taste, and overall liking than the control not dipped in brine solution. It had higher dehydration rate (154.1%) and lower water activity (0.835) which indicates longer shelf-life. The sample had pH value of 6.56. The dried *tilapia* had 4.2% moisture content, 37.8% crude protein, 11.4% crude ash, 23.9% crude fat, 0.7% crude fiber, and 22.8% carbohydrates. Both tilapia samples were deemed safe for consumption as shown by their low total aerobic plate count and the absence of coliform, *Escherichia coli*, molds, and yeasts. In roasting the chicken, the oven reached the required minimum temperature (74°C) after 1hr while the highest internal temperature of 90.2-94.8°C was obtained after 2hr. Sensory evaluation showed comparable scores of the sample with the commercial roasted chicken for color (inside), overall appearance (outside and inside), aroma, doneness, and tenderness. It had overall acceptability of 7.1 equivalent to "like moderately." In terms of color, the roasted chicken was generally comparable with the commercial roasted chicken in terms of lightness (L*), redness (a*), and yellowness values (b*) of the outside and inside parts of the chicken. For proximate composition, both samples had comparable ash, protein, and fiber but the samples roasted in the cylindrical oven had higher moisture and fat content. This study shows that both the cubical- and cylindrical-type ovens are effective heat recovery attachments to the carbonizer and can be efficiently utilized in food processing.

Keywords: carbonizer, heat recovery, cubical-type oven, cylindrical-type oven, sensory evaluation

AGROBACTERIUM-MEDIATED GENETIC TRANSFORMATION OF EGGPLANT C.V. (*Solanum melongena* L.) TOWARDS DEVELOPMENT OF GENOME-EDITED CROPS

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Genetic transformation and plant regeneration are essential biotechnology tools for successful crop improvement using genetic engineering (GE) and new breeding techniques (NBT). There is great potential in utilizing GE and NBT in eggplant (*Solanum melongena* L.), one of the most economically important vegetables crops grown and consumed in the Philippines. Genetic transformation and plant regeneration of eggplant has been reported previously but the process is genotype-dependent. This study is the first report of a successful *Agrobacterium*-mediated genetic transformation and plant regeneration of a Philippine eggplant accession, 'PHL 11424'. Cotyledons from two-week old seedlings were used as explants, which were transformed with disarmed *Agrobacterium tumefaciens* strain LBA4404 harboring a binary vector for CRISPR/Cas9 expression, which target three polyphenol oxidase genes (*PPO4, 5* and *6*) that code for enzymes that cause browning of the fruit flesh, and hygromycin phosphotransferase (*HPT*), an antibiotic selection marker. Shoot primordia growth from the agroinfected explants was observed during selective culture with 7.5 ppm hygromycin, which indicated an initial transformation success. The putatively transformed shoot primordia were then transferred to an elongation medium. The elongated and hygromycin-resistant shoots were allowed to develop roots in hormone-free medium supplemented with hygromycin, and subsequently acclimatized under greenhouse conditions. The entire process took at least 5 – 6 months. Of the total 585 agroinfected explants, the regeneration efficiency of rooted shoots was 3.9%. Successful transformation was confirmed by polymerase chain reaction (PCR) amplification of *Cas9* and *HPT*. Transformation efficiency among the regenerated plants was 100%. All acclimatized plants tested positive for the presence of both transgenes. Genome editing was also confirmed in the three target polyphenol oxidase genes (*PPO4, 5* and *6*). Analyses of fruit browning reaction, transcript/PPO activity and generation of T_1 plants for inheritance studies are in progress. These results demonstrate a working *Agrobacterium*-mediated transformation protocol of Philippine *S. melongena* using cotyledons as explants, as well as an initial demonstration of genome editing for a vegetable crop in the Philippines. Furthermore, these results will provide a useful platform for future eggplant genetic engineering and genome editing studies and pave the way towards a more robust Philippine biotechnology.

Keywords: eggplant, *S. melongena*, Agrobacterium-mediated transformation, plant, regeneration, genome editing

ASSESSMENT OF PURPLE AND ORANGE-FLESHED SWEET POTATO (*Ipomoea batatas*) ACCESSIONS BASED ON GENETIC DIVERSITY, ANTHOCYANIN, AND BETA-CAROTENE CONTENT

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Nutrient deficiency is a prevalent problem in the country with increasing rate of stunting (~29% in 2019) among children (Mbuya et al., 2021). Sweetpotato as a major source of food and feed in many developing countries has great potential in alleviating hunger and malnutrition. Hence, biofortification through plant breeding and crop improvement programs can be employed. This study evaluated the purple and orange-fleshed sweetpotato accessions through analysis of biochemical component and genetic diversity. Anthocyanin as a source of anti-oxidant and beta-carotene for vitamin A fortification were quantified using pH differential method and high-performance liquid chromatography (HPLC). Analysis of variance showed significant differences for all biochemical parameters except starch content. Anthocyanin content of purple genotypes ranges from 12.35mg L^{-1} to 138.044 mg L^{-1} where eight individuals obtained higher values against check variety. Beta-carotene ranges from 49.48 to 233.73 ug/g sample where SG18-80-02, SG18-146-1 and SG18-88-01 exhibited higher values compared to the check variety. Percent dry matter across hybrids ranges from 20.96 to 36.33 while percent starch content ranges from 76.23 to 82.35 with highest value obtained from SG18-70-03 and SG18-10-01, respectively. Meanwhile, genetic diversity analysis was carried out using 25 simple sequence repeats (SSR) markers. Phylogenetic analysis grouped sweetpotato accessions into 6 clusters at approximately 0.88 Jaccard's distance using Unweighted pair group method with arithmetic mean (UPGMA). Polymorphic information content (PIC) values range from 0.823 to 0.952 with mean of 0.898 indicating high genetic polymorphism (PIC>0.5). Highest PIC was calculated from IBM 261 with 0.952. Minimum dissimilarity of 0.74 was observed from SG18-136-02 and SG18-135-01 obtaining the highest genetic relatedness across accessions. This can be used as basis of future breeding programs and varietal development for high anthocyanin and beta-carotene content.

Keywords: sweet potato, anthocyanin, beta-carotene, genetic diversity, SSR primer, PIC

ASD-35

BIOTECHNOLOGY USING MICROSATELLITE MARKERS IDENTIFIES BLOOD PERCENTAGE PROPORTION OF WATER BUFFALOES (*Bubalus bubalis*)

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The domesticated water buffaloes (*Bubalus bubalis*) and their hybrids are mainly identified based on common physical features. Due to emerging propagation, selection of animals for dispersal, and continuous upgrading of swamp buffaloes to produce an improved breed of Philippine carabao, it is essential to identify animals according to their breed categories: pure swamp-type (P0), pure river-type (P1), crosses of swamp and riverine (F1), crosses of F1(F2), backcross to the swamp (0BX), and backcross to riverine (1BX) buffaloes. This is a common scenario when animals raised in the backyard face uncontrolled crossbreeding and the absence of pedigree records. However, the morphological-based identification system could be limited to determining the breeds of water buffaloes. The DNA-based system using microsatellite loci for breed identification is vital in deciding the animals' reasonable market price and value-adding. The study aimed to assess the utility of microsatellite markers to identify pure water buffaloes and estimate the percentage composition of the riverine bloodline in crossbred buffaloes. Twelve microsatellite markers of the nuclear DNA on the water buffaloes (n=128) were randomly selected from Calayan Island in Cagayan, Nueva Ecija, Pitogo Island in Bohol, Cebu, and PCC Genepool. DNA was isolated from the whole blood, and the nuclear DNA of the swamp buffalo was amplified using the polymerase chain reaction (PCR). Amplified PCR products were performed for fragment analysis and further analyzed using the Geneious Prime® (v2021.1 Biomatters Ltd.). The identification of membership co-ancestry of crossbred buffaloes using STRUCTURE software. In addition, the Bayesian iterative algorithm software was used to evaluate an individual's posterior probability (PP) of belonging to hybrid or parental classes. Using 12 STR markers, this study established the DNA profiles of reference samples for the pure-type (P0 and P1) and their hybrids (F1, F2, 0BX, and 1BX). Fifty-three crossbred samples were successfully assigned to categories at least 70% PP. Thus, research findings highlighted the usefulness of a robust water buffalo genotypic database to determine riverine bloodlines for animal traceability.

Keywords: animal traceability, crossbred, hybrid buffaloes

ASD-36

CHARACTERIZATION AND EVALUATION OF SELECTED 'SIBUJING' (*Allium chinense* G.Don) ACCESSIONS FROM MINDANAO, PHILIPPINES BASED ON MORPHOLOGY, PHYTOCHEMICAL CONTENTS, GROWTH, AND YIELD PARAMETERS

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'Sibujing' or 'sakurab' is an emerging *Allium* species in the Philippines and commonly used as a native condiment and ingredient in a common side dish 'palapa' by the Maranao people in Mindanao region as well as medicine in many parts of Asia. However, despite its importance, it has not been deeply studied and there are no registered varieties of 'sibujing' made by public institutions which call for a deep understanding and scientific information that can be valuable to researchers, students, farmers and breeding programs. Hence, characterization and evaluation of six 'sibujing' accessions were done based on morphology, growth parameters, yield and yield components and phytochemical contents. Minimal morphological variations were observed in leaves and bulbs, but one distinct feature across the accessions was the pentagonal hollow cross-section of leaves. Tannins and alkaloids were absent in fresh bulbs while flavonoids and saponins were detected denoting its potential health benefits. Among accessions, ICROPS 1395 from Lanao del Norte had the promising agronomic performance in terms of total fresh biomass (19.73 tons ha^{-1}), bulb fresh mass (9.6 tons ha^{-1}), bulbs hill[-1](24), leaves hill[-1](65.6), tillers hill[-1] (31), shaft diameter (3.89 ± 1.60 mm) and bulb diameter (9.51 ± 0.49 mm). These findings are timely and relevant as 'sibujing' can be an alternative spice or condiment to onions which is currently experiencing price hike, supply shortage and importation. Further evaluation across different environments and cropping seasons is recommended for future study.

Keywords: palapa, five-angled hollow leaves, flavonoids, saponins, bulb fresh mass

ASD-37

COMPARATIVE ANALYSIS OF ABACA (*Musa textilis* née) PLASTOMES REVEALS LOW CHLOROPLAST GENOME VARIATION

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Abaca (*Musa textilis* Née), an economically important industrial crop indigenous to the Philippines, is the source of the strongest natural fibers internationally known as Manila hemp. The breeding of elite abaca is dependent on the proper identification and characterization of the collections in the abaca germplasm. We sequenced, assembled and analysed the chloroplast (cp) genomes of twelve abaca cultivars (Abuab, Hagbayanon, Ihalas, Inosa, Kutay-kutay, Laylaly, Luno, Luno Green, Samoro, Socorro, Tangongon, and Tinawagang Puti) to investigate and compare the structure of the cp genomes. These genomes were assembled using GetOrganelle and annotated via GeSeq, cpGAVAS2 and PGA. Alignment of whole annotated sequences was done using the MAUVE and mVISTA alignment programs and phylogenetic analysis was performed using PhyloHerb wherein the nucleotide sequences of 22 species from 87 protein-coding genes where concatenated and used to construct the tree. All twelve cp genomes have circular structures of around 168,249 to 168,507 bp and exhibit the typical quadripartite organization consisting of a large single copy region (LSC; 88,074 to 88,429 bp), a small single copy region (SSC; 11,020 to 11,057 bp) and a pair of inverted repeat regions (IRs; 34,438 to 34,671 bp). Annotation revealed that the cp genomes contained 133 genes made of 88 protein-coding genes, 37 tRNA and 8 rRNA genes. Alignments of the twelve abaca cp genomes to other Musa spp. cp genomes showed comparable genome lengths, number of genes annotated and the relative positions of the genes within the genomes. Repeats analysis showed consistency among the 12 varieties where the forwards are repeated the most (56.2%-63.2%) and the complementary being the least commonly repeated (0-0.4%). Nucleotide diversity analysis showed Pi values less than 0.009 across the whole cp genome sequence, suggesting small differences among the *M. textilis* chloroplast genomes. Phylogenetic study revealed the 12 abaca cp genomes shared 87 protein-coding genes with eight monocot species including *Oryza sativa*, *Ensete glaucum* and *Elaeis guineensis*. The 12 varieties can be divided into two distinct clades with select varieties exhibiting zero genetic distance. This is the first comprehensive study of the abaca plastome and the first detailed study on the chloroplast genome of *Musa textilis* Née which will be valuable in future population genetic and phylogenetic studies for abaca breeding programs.

Keywords: chloroplast genome, musaceae, *musa textilis*, phylogenetics, next generation sequencing

COMPARISON OF VIABILITY AND QUALITY OF POLLINIA ON THE DAYS OF ANTHESIS AND SENESCENCE OF DIFFERENT *Hoya* SPECIES

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Hoya is the largest genus of Asclepiadaceae family, comprising more than 800 species distributed in Southern Asia, Australia, and Polynesia. Despite species diversity, information on the pollen biology of this flowering plant is very limited. Studies on pollinia viability, fertility, and quality are crucial for successful breeding programs. *Hoya* species that retain pollinia viability and quality until flower senescence is useful in providing gametes in the planned breeding activities. To compare the viability and quality of pollinia on the first and last day of anthesis, pollinaria of 13 *Hoya* species under the following sections: *Otostemma, H. cumingiana* complex, *H. potsii* complex, *H. blashernaezii* complex, *Acanthostemma*, *Peltostemma*, *Amblyostemma*, *Pachystelma*, *Oreostemma*, and *Pachystelma* were germinated artificially using Brewbaker and Kwack's (BK) medium. The pollen germination percentage and length of pollen tubes were assessed after 24 hours of incubation. Most of the species studied retained their pollinia viability and quality until the last day of anthesis. Based on pollen tube length, results showed that there is no significant difference (a=0.05) in the quality of pollinia on the first and last day of anthesis for *H. benguetensis, H. darwinii, H. mindorensis, H. siariae, H. imbricata, H. fitchii,* and *H. obscura*. On the other hand, pollen tube growth in *H. blashernaezii, H. buotii*, and *H. diversifolia* was significantly higher (a=0.05) on the last day of anthesis compared to the first day of anthesis. Meanwhile, the quality of pollinia of *H. cardiophylla, H. lucardenasiana*, and *H. densifolia* was considerably reduced (a=0.05) during the period of flower senescence. Four hoya species namely *H. densifolia, H. imbricata*, *H. lucardenasiana*, and *H. obscura* had reduced pollen germination during the period of flower senescence. The current findings will be useful in the varietal development and improvement of Philippine *Hoyas.*

Keywords: breeding, *Hoya*, pollinia

ASD-39

ESTABLISHMENT OF A SCREENING PROTOCOL TARGETING HIGHLY-BRANCHED ROOT SYSTEM FOR EFFICIENT RICE BREEDING AND BIOTECHNOLOGICAL APPLICATIONS

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With water scarcity as an increasing concern that negatively affects plant development and agricultural productivity, roots, being suggested as the key to a second revolution, have recently gained an attention to many researchers especially plant breeders because it is one of the ways to improve the aboveground traits to sustain production. In rice, accumulated evidences for two decades have reported that phenotypic root plasticity particularly highly-branched root development is essential for stable production under variable water stress conditions. However, application of the trait as a breeding index is limited until now due to the laborious and difficult process involved in root research that includes growing the plants, digging them up and measuring their roots. In this study, we established a combined hydroponics set-up and a modified rapid generation advancement (RGA) technique as an efficient screening protocol by utilizing the recently identified *weg1* mutation gene (which promotes a highly branched root system) as a breeding material introgresssed to popular and high-yielding Philippine rice varieties (NSIC Rc402, NSIC Rc160 and NSIC Rc480) to improve their drought resistance via enhanced root architecture. Every filial generation from the mapping populations was grown in a hydroponics set-up for 15 days only and lines were root phenotyped to non-branching, moderately branching and highly-branched roots. Afterwhich, the pre-selected lines with highly-branched root system were transplanted in a modified RGA using a screenhouse field with half of the total number of lines grown in seedling trays (104 holes) filled with clay soil while the other half were grown in garden soil. Results showed that progenies from each generation advancement were clearly phenotyped to non-branching, moderately branching and highly-branched lines by visual observation of lateral root development particularly along the seminal root. For instance, out of the 3,335, 14,340 and 5,179 F3 seedlings from the above genetic backgrounds, respectively, 1,065, 4319 and 2,130 possessing highly branched root systems were pre-selected. Those lines, which we did not select (non-branching and moderately branching) mean savings from our genotyping activities and is around 60-75%. In the modified RGA, the frequency of lines that head earlier and had greater height was greater in garden soil than in clay. Thus, garden soil may induce shorter duration of rice growth, which is by 7-10 days. This method of early selection of lines targeting highly branched root systems combined with the modified RGA allowed us to save 60-75% of time, cost and labor both in screenhouse and laboratory procedures for every filial generation advancement, thus reflecting their importance for breeding and biotechnological applications in improving rice root architecture.

Keywords: breeding protocol, root system, mutation gene, rice, rapid generation advancement

ASD-40

EVALUATION OF GREATER YAM (*Dioscorea alata* L.) ACCESSIONS BASED ON GENETIC DIVERSITY AND ANTHOCYANIN CONTENT

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The diversity of one hundred forty-eight greater yam (*Dioscorea alata* L.) accessions from the collections of the National Plant Genetics Resources Laboratory (NPGRL), Visayas State University (VSU), and Institute of Crop Science-University of the Philippines Los Baños (ICROPS-UPLB) was evaluated using 54 Dioscorea-based SSR markers. Polymorphic bands were amplified in 50 SSR markers with a mean PIC value of 0.83. The cluster analysis generated 9 distinct clusters with Jaccard's distance index of 0.85 implying 85% dissimilarity among the greater yam accessions. The approximately unbiased (AU) p-value based on the multiscale bootstrap with 5000 times resampling generated 9 significant clusters (AU p-value > 0.95) at clusters II, IV, VIII, and IX with 0.05 level of confidence. Overall, high dissimilarity rates obtained from the molecular analysis of 148 greater yam accessions revealed high genetic diversity. Thus, 8 greater yam accessions comprising PHL 33537, LA 068B, PHL 33550, PHL 31889, LA 110, LA147, TABACO, and LA 597 were recommended in choosing potential parents for future breeding programs. In a concurrent experiment, selected *D. alata* tubers from the aforementioned collections were submitted to the Analytical Service Laboratory (ASL-UPLB) for subsequent anthocyanin content analysis using the pH differential method. Out of the 25 purple yam accessions selected, 23 tuber samples yielded results while 2 samples produced insufficient data. Anthocyanin content of selected tubers ranged from 4.4 mg/L (PHL 33537) to 46.8 mg/L (LOBO). Three purple yam genotypes – DEL GALLEGO 2, LA 590, and LOBO, obtained anthocyanin content >30 mg/L at 32.3 mg/L, 36.4 mg/L, and 46.8 mg/L, respectively. On the other hand, seven accessions (PHL 31914, PHL 33451, PHL, 33537, VILLASIS 1, LB 2, LIPA, and LA 157A) obtained anthocyanin content <10 mg/L. From the previously recommended yam accessions, two were subjected to anthocyanin content evaluation. PHL 33537 obtained a monomeric anthocyanin content of 4.40 mg/L while TABACO obtained a monomeric anthocyanin content of 13.9 mg/L. Data acquired from the anthocyanin content evaluation of greater yam can be utilized as a benchmark for further studies. Furthermore, information obtained from this study could be essential in various greater yam improvement programs and genetic resource conservation measures.

Keywords: *Dioscorea alata* L., greater yam, genetic diversity, SSR, anthocyanin

ASD-41

EVALUATION OF SOYBEAN (*Glycine max* [L.] MERR.) LINES FOR IMPROVED SEED YIELD IN A FARMER'S FIELD

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Seed yield of most Philippine soybean varieties is relatively low compared to foreign varieties and therefore, needs to be further improved. Selected superior breeding lines usually perform well in crop research stations. Nonetheless, one of the ultimate tests prior to their submission for the "National Cooperative Trial of Field Legumes" should be their performance under less ideal conditions in farmers' fields. Such evaluation can be an integral step of any crop breeding program that gives assurance if advanced lines are indeed better and improved. As such, this study laid out in Randomized Complete Block Design with three replications was conducted from February to May 2022 in a slopy farmer's field in Banlag, Valencia City, Bukidnon to specifically (1) characterize 14 soybean genotypes mostly breeding lines developed by IPB-UPLB and IITA [International Institute of Tropical Agriculture]; (2) determine their phenotypic diversity; (3) determine the traits associated with seed yield; (4) estimate the similarity between and among soybean genotypes; and (5) identify the best genotypes based on seed yield performance. Three soybean genotypes exhibited very poor germination and were dropped from the study. Eleven quantitative and 2 qualitative traits were phenotyped. Data were analyzed using ANOVA, Tukey's (HSD) test, Pearson's Product Moments Correlations, Cluster analysis, Principal Component Analysis (PCA) and Standardized Shannon-Weaver Diversity Index (SSWDI, H'). All 11 quantitative traits (days to emergence, percent germination, days to flower, duration of flowering, plant height at maturity, lodging score at maturity, number of pods per plant, pod length, number of seeds per pod, 100-seed weight and grain yield) highly differed among the genotypes ($p<0.01$). Three pureline selections were the highest-yielding but comparable with the check NSIC 2019 Sy 14 (2,004.15 kg ha^{-1}): TG x 2004-7E (2,788.29 kg ha^{-1}), IPB Sy 2012-02-09 (2,136.75 kg ha^{-1}) and IPB Sy 2012-02-06 (1,972.03 kg ha^{-1}). The other check NSIC 2019 Sy 12 was outyielded by most of the lines. All genotypes recorded low lodging scores. Seed yield was only associated with number of pods per plant (r= 0.7088). Cluster analysis using Ward's Minimum Variance showed Cluster 1 with five genotypes that included the two IITA lines and cluster 2 with six genotypes containing all IPB-UPLB lines except for IPB Sy 2012-02-09. PCA revealed that the first four principal components accounted for 87.41% of the total variation: PC1 (34.44%), PC2 (23. 94%), PC3 (15.82%) and PC4 (13.21%). PC1 was largely accounted for by days to flowering, plant height at maturity, number of pods per plant, and seed yield. SSWDI estimated high phenotypic diversity for all quantitative traits with mean of H'=0.77 and moderate diversity for qualitative traits with mean of H'=0.50.

Keywords: farmer's field, pureline evaluation, seed yield, soybean breeding, yield-related traits

ASD-42

GENE MINING AND *IN SILICO* ANALYSIS OF THE NIK1 GENE FROM ABACA (*Musa textilis* NÉE)

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Abaca fiber production, of which the Philippines produces approximately 85% of the global demand, is hampered by viral disease infections. The most devastating of these is the Abaca bunchy top disease (ABTD) caused by the Abaca bunchy top virus (ABTV), a single stranded, multi-component DNA virus. Although ABTV is well-characterized, there is a lack of studies on plant resistance mechanisms against the virus at the molecular level. One viral resistance mechanism involves the gene Nuclear Shuttle Protein-Interacting Kinase 1 (NIK1). This gene halts viral infection by repressing the cell's global translation mechanism that prevents viral replication. Studies have shown though that NIK1 can be countered by the Nuclear Shuttle Protein (NSP) of single stranded DNA viruses in the family *Geminiviridae*. The NIK1-NSP interplay has been well-studied in *Arabidopsis thaliana* and geminiviruses. Despite being in the family *Nanoviridae*, ABTV also expresses NSP but there have been no studies so far that show if abaca has NIK1 homologs. To determine if the NIK1-NSP interplay occurs for abaca and ABTV, this study aims to mine NIK1 homologs from the assembled abaca genome (variety Abuab) and functionally characterize the genes using bioinformatics analysis. The results of gene mining identified nine distinct NIK1 homologs which are comparable to NIK1 homologs mined from closely related *Musa acuminata* and *Musa balbisiana* genomes which contain seven to nine NIK1 homologs. The characteristic N-terminal LRR domain and C-terminal serine/threonine kinase domain were present and well-conserved as analyzed using Pfam. Subcellular protein localization analysis predicted more than 60% of NIK1 proteins are expected to localize in the cytoplasm which is expected. Predicted protein network interactors are consistent with those observed in literature. The structures of the generated protein models are comparable to *Arabidopsis* NIK1 with more diversity observed in the N-terminal LRR domain. *In silico* analyses of the nine putative homologs indicate their identity and functions as NIK1 proteins. Further studies such as cloning, PCR, and protein expression are needed to confirm these results.

Keywords: abaca, NIK1, ABTV, NSP, bioinformatics

ASD-43

GROWTH AND YIELD RESPONSE OF CLSU'S SPECIAL PURPOSE TALL RICE VARIETIES TO PACLOBUTRAZOL APPLICATION

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Special purpose rice (SPR) are distinct for their novel traits such as the presence of aroma, pigmentation, and low level of amylose content. The three CLSU's SPR varieties included in this study are taller during WS, hence these are prone to lodging. On the other hand, paclobutrazol (PBZ), a growth retardant could shorten the internodes and decrease lodging incidence of the tall SPR varieties. Hence, the study was carried out to assess the growth and yield response of the selected CLSU's SPR varieties to PBZ application. The experiment was laid out in split-plot Randomized Complete Block Design (RCBD) with three replications. Three levels of PBZ concentration, 0 ppm, 2000 ppm and 4000 ppm were used as the main treatments and the three SPR varieties, CLS-1 (white aromatic), CLS-2 (pigmented aromatic), and CLS-9 (white sticky) were used as sub treatments. The yield and other agronomic traits were analysed using the IRRI statistical Software (STAR). Means were compared using the Least Significant Difference (LSD). Results revealed significant differences among varieties for number of days to flowering, number of days to maturity, stem diameter, culm length, plant height, length of internode, panicle length, weight of 1000 seeds, grain yield per plot, and grain yield per hectare. The application of PBZ at 2000 and 4000 ppm increased in stem diameter by 24.12 and 26.92%; shortened plant height by 27.26 and 27.64%, shortened culm length by 40.19 and 39.92%, shortened length of internode by 2.80 and 12.31% and increased yield by 13.07 and 16.88%, respectively over the control (0 ppm). On the other hand, CLS-2 had the longest internode length (20.34 cm) compared to CLS-1 and CLS-9. Likewise, CLS-9 at 2000 ppm and the control varied in panicle length with 23.1 and 22.70 cm, respectively. Based on the results of the study, the application of 4000 ppm had the greater influence in reducing lodging incidence (0.22%) of the tall SPR varieties significantly lower than 2000 ppm (0.56%) and the control (6.00%). For more conclusive and valid results, further evaluation during WS using the same treatments is recommended.

Keywords: paclobutrazol, rice, lodging, agronomic traits

ASD-44

IDENTIFICATION OF DROUGHT TOLERANCE, ANAEROBIC GERMINABILITY, AND RICE BLAST AND TUNGRO VIRUS RESISTANCE IN PHILIPPINE TRADITIONAL RICE VARIETIES (*Oryza sativa L.*) USING SNP MARKERS

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Abiotic stresses frequently combined with biotic stresses often lead to the decline in rice yield. With the current increasing trend of global food demand, the continuous identification and selection of rice varieties with favorable quantitative trait loci (QTL) against these pressures is an essential part of marker assisted selection (MAS) for the development of varieties adapted to climate change, and disease outbreak. Trait genotyping using SNP markers for drought stress during reproductive development (DS), anaerobic germinability (AG), and rice blast and tungro resistance QTLs was carried out for 190 accessions of traditional rice varieties obtained from the UPLB rice germplasm collection. Presence of favorable alleles for four major QTLs for DS – $qDTY_{1.1}$, $qDTY_{2.2}$, $qDTY_{3.1}$, and $qDTY_{12.1}$ were observed across the collection with varying frequency. Overall, 137 accessions exhibited favorable allele for $qDTY_{2.2}$, 111 for $qDTY_{3.1}$, 40 for $qDTY_{1.1}$, and 22 for $qDTY_{12.1}$. Meanwhile, for AG QTLs, *qAG1* and *qAG3*, 98 and 144 accessions exhibited favorable allele, respectively. Remarkably, 90 accessions mutually possessed positive alleles for both anaerobic germination QTLs. Biotic stress resistance was determined for the major QTLs of blast (*Pik* and *qPi33*) and tungro (*TBV1* and *STV11*). For blast resistance, only one accession out of 190 germplasm accessions – *Gabon-Gabon*, showed favorable allele for *Pik* while 90 accessions showed favorable allele for *qPi33*. Furthermore, for tungro resistance, 20 accessions had favorable allele for *TBV1*, and 61 accessions had favorable allele for *STV11*. Interestingly, 15 accessions jointly showed favorable alleles for tungro resistance QTLs such as *Kinalansing, Kagting, Linangka, Kinalawang, Bakhaw, Milagrosang Baroyan, Super Pilit, Biniding, Oklan, Dumaliday, Lubang (Red)* and four accessions of *Milagrosa*. Identified traditional rice varieties with QTLs will be used for MAS to accelerate breeding and gene pyramiding of economically important traits in rice.

Keywords: abiotic stress, biotic stress, rice, QTL, SNP markers

ASD-45

FARMER-CENTRIC SELECTION OF RICE GENOTYPES FOR ORGANIC RICE PRODUCTION

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Unavailability of rice varieties or genotypes that are responsive to low-input system is one of the major challenges of organic rice production. Oftentimes, organic rice farmers rely on the varieties released from conventional breeding or use traditional varieties. Understanding the preferences of organic rice farmers is an important step for breeding programs who aims to develop varieties that are acceptable to the farmers. Ideally, breeding programs should work jointly with farmers in evaluating varieties and capturing their interests allows breeders to understand the variability of preferences from location to location. Participatory Varietal Selection (PVS) encourages joint activity of breeders, extensionists, and mostly farmers to select for preferred genotypes in the field. This approach will help breeders identify traits that farmers consider in choosing for rice varieties for organic rice production. Our study implemented PVS to identify and understand organic rice farmers criteria for selecting varieties. Diverse genotypes composed of newly-released, nationally and regionally-recommended, and traditional varieties were evaluated in on-station and researcher's managed trial (mother trial). Top performing varieties that are selected by farmers in the PVS were further evaluated in off-station and farmer-managed trials (baby trials). NSIC Rc 400, 440, and 480, PSB Rc 18, and Calatrava were top performing genotypes in terms of grain yield in the mother trial. Agronomic traits such as biomass, harvest index, and grain weight showed significant positive correlation with grain yield. Hence, selection for these traits will be helpful in improving grain yield under organic system. Grain yield is important however, this is not the sole basis of organic farmers in selecting varieties. Farmers preferred early-maturing, long-grains, fully-filled, and hides it panicles, resistant to pests, pigmented, and have more tillers. Early maturing genotypes are preferred since it provide escape to adverse weather conditions while good panicle characteristics equate for good yield. Resistant to major insect pest and diseases are one of the important traits to consider in organic system. Meanwhile, farmers prefer pigmented genotypes since they dictate premium prices compared to unpigmented genotypes. Among the genotypes evaluated, NSIC Rc 400, PSB Rc 18, NSIC Rc 216, PSB Rc 10, NSIC Rc 440 and Mailum Black were the farmers' top choices. Genotypes that are preferred by farmers with high-yielding capacity were further evaluated in baby trials. Paired t-test of baby trials showed that NSIC Rc 400, NSIC Rc 440, NSIC Rc 216, and PSB Rc 18 has yield advantage of 80%, 31%, 30%, and 11%, respectively over the farmers' variety. These genotypes can be directly recommended to organic rice farmers for cultivation or can be characterized and utilized by plant breeders in developing varieties suited to organic system and are preferred by rice farmers that will ensure higher and stable productivity in organic rice production system.

Keywords: baby trial, genotypes, mother trial, organic, participatory variety selection, rice

ASD-46

LOOP-MEDIATED ISOTHERMAL AMPLIFICATION (LAMP)-BASED COLORIMETRIC DETECTION OF ACUTE HEPATOPANCREATIC NECROSIS DISEASE IN *Litopenaeus vannamei* USING ANTHOCYANIN EXTRACT FROM VARIOUS LOCAL PLANTS

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Shrimp aquaculture is considered a fast-growing and an economically-important industry, especially in developing countries; however, production is continuously afflicted by the uncontrollable occurrence of severe bacterial diseases such as Acute Hepatopancreatic Necrosis Disease (AHPND) caused by *Vibrio* spp. Current diagnostic methods for the pathogen include the highly sensitive, specific, and cost-effective loop-mediated isothermal amplification (LAMP). Under low buffering conditions, the change in pH due to the production of hydrogen ions during DNA amplification allows naked-eye visualization of LAMP products by pH-sensitive dyes, thus eliminating the need for synthetic DNA-intercalating stains, agarose gel electrophoresis, and ultraviolet (UV) equipment. To further maximize the cost efficiency of LAMP, this study examined the applicability of anthocyanin extracts from local plants as alternative pH-sensitive stain in the colorimetric LAMP assay for AHPND in *Litopenaeus vannamei* samples. The pH-changing mechanics of red cabbage, beetroot, and purple potato was found optimal to the required LAMP-pH conditions, and are capable of detecting up to 1.87×10^4 pg of pathogenic DNA. Parallel assay also showed 10 times more sensitivity of LAMP-pH than the Polymerase Chain Reaction (PCR). The existence of alternative DNA detection dyes provides cheaper, safe, and more accessible detection methods which is highly advantageous to various sectors all over the country.

Keywords: Acute Hepatopancreatic Necrosis Disease*, Litopenaeus vannamei,* pH, natural dye

ASD-47

METABOLOMIC PROFILING OF FRAGRANCE RELATED VOLATILE COMPOUNDS AND FLAVONOIDS OF SELECTED SPECIAL PURPOSE RICE ACCESSIONS

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Special purpose rice (aromatic, pigmented, and glutinous) is a promising competitive rice group as it possesses special qualities and commands a higher price in the market. The aroma is an important characteristic of high-quality rice because of the strong human preference for fragrance. In addition, epidemiological studies have shown that consumption of antioxidant-rich rice can be correlated to low incidence of chronic diseases. Thus, this research project aimed to evaluate the fragrance based on qualitative (KOH assay) and quantitative (Gas Chromatography-Mass Spectrophotometry) analysis of rice volatile compounds, and antioxidant property based on the relative amount of flavonoids in the endosperm of special purpose rice. For fragrance, 100 special purpose rice accessions comprising of inbred, protected (PVP), and advanced yield trial (AYT) lines were screened using KOH assay based on the presence of aroma in the leaf and grain. Consequently, the top 20 aromatic rice were forwarded to GCMS analysis for the untargeted profiling and relative quantification of volatile compounds. Thirty-six volatile compounds related to rice aroma were detected and three key-marker compounds (hexanal, nonanal, and 2-pentylfuran) responsible for typical cooked rice smell were quantified. Sensory evaluation revealed five aromatic rice accessions with strongly scented qualities and high consumer preference. On the other hand, the selected 20 special purpose rice accessions were screened for the presence of flavonoids in the endosperm in terms of chrysanthemin and quercetin equivalents using UV-Vis spectrophotometry at 535 nm and 374 nm, respectively. Statistical analysis revealed three accessions with significantly high amounts of chrysanthemin and quercetin contents: CLR129 (a CLSU AYT line) with 183.23mg/kg and 226.24 mg/kg, CLRice 2 (CLSU pigmented rice under Plant Variety Protection) with 182.73 mg/kg and 204.65 mg/kg, and *Pirurutong* with 147.74 mg/kg and 169.47 mg/kg, subsequently. Therefore these results gears towards a better understanding of the rice fragrance and antioxidant properties that could be the basis for varietal selection and rice breeding for higher value and healthier consumption.

Keywords: special purpose rice, fragrance, volatile compounds, anti-oxidant, flavonoid

ASD-48

MOLECULAR PHYLOGENETIC AND CODON SELECTION ANALYSES OF THE COMPLETE CODING SEQUENCE AND PROMOTER REGION OF THE ß-LACTOGLOBULIN GENE

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ß-lactoglobulin (*BLG*) is one of the most promising candidate genes to be used as a suitable genetic marker for important milk production traits in cattle. *BLG* is a 4.7 kb long gene that has been mapped on bovine chromosome 11. It codes for ß-lactoglobulin, the major whey protein in the milk of most mammals, but is absent in milk from humans, camels, rodents and lagomorphs. Its specific function is not yet fully known although it is speculated to perform a major role in the transport of certain molecules such as retinol, cholesterol and vitamin D. Hence, this study conducted an *in silico* analyses of the complete coding sequence and promoter region of the ß-lactoglobulin gene, not only to show the phylogenetic relationships of different eutherian mammals but also to gain a better understanding of the function of this protein by looking into the selection that influenced its genetic variation in the population. Bayesian inference and maximum likelihood analyses revealed phylogenetic groupings that were consistent with the present taxonomy of the 13 selected eutherian taxa. There was no clear separation of the taxa according to milk nutrient composition since taxa that are known to produce milk with high fat, protein or lactose content did not cluster together. Further evolutionary analyses using Selecton and Datamonkey Adaptive Evolution Server via the MEME, FEL and FUBAR algorithms identified codon sites under positive and negative selection. There were signatures of positive diversifying selection at D96, K100, S110, E112, P113, Q115, V118, V128, A139, A142 and F151 among other codon sites of the *BLG* gene. These sites were mainly located in the α-helical coils outside the ß-barrel. In contrast, sites undergoing negative purifying selection were in the ß-strands in the vicinity of ligand-binding sites of the ß-barrel, supporting the proposed transport function of BLG. Lastly, using the MEME Suite's GOMo and TOMTOM tools, ten conserved motifs were identified in the promoter region of the BLG. Two of which were shown to be putative binding sites of a zinc finger transcription factor that may possibly regulate transcription of the gene. The absence of these motifs in *Equus caballus* could explain why *BLG* expression in horses is relatively lower than bovids.

Keywords: ß-lactoglobulin, molecular phylogeny, codon selection, DNA-binding motifs

ASD-49

PERFORMANCE OF CLONED KATMON
(*Dillenia philippinensis* **Rolfe***)*

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Katmon (Dillenia philippinensis) is a tree and an endemic species in the Philippines. It is a flowering plant that grows in low to medium altitude forests. It is propagated by seed, but they are currently on the list of threatened species due to timber harvesting. The study assessed the performance of Cloned Katmon (*Dillenia philippinensis*). The experiment was set up using a completely randomized design (CRD), and the plants were exposed in the nursery in bigger 10" x 6" pots. Since the p-value was higher than the significance threshold of 5%, the analysis of variance shows no significant relationship between height, diameter, number of leaves, leaf area, chlorophyll content, and percent survival. The findings show that after 45 days, the cloned katmon can thrive well outside the chamber and in a larger pot. It is highly recommended that cloned katmon that was only exposed in nurseries should be exposed in the field to assess performance and survival rates. It is also possible to domesticate the cloned Katmon, which typically thrives in the wild and has the potential as an indoor or commercial plant.

Keyword: chlorophyll content, Katmon (*Dillennia philippinensis*)

PHENOTYPIC AND GENOTYPIC CHARACTERIZATION OF SPECIAL PURPOSE AROMATIC RICE FOR EFFICIENT PARENTAL SELECTION AND SPECIAL PURPOSE RICE IMPROVEMENT

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Special purpose rice (SPR) is regarded as a premium rice variety in the market for having excellent eating quality characteristics and high nutritional composition. Aromatic rice is one of these special purpose rice varieties which possess a pandan-like aroma when cooked. Aside from this, aromatic rice is known to have a lower glycemic index than regular white rice. However, the agro-morphological and genetic characteristics of these varieties are not well known. Thus, this study aims to characterize different SPR accessions for their phenotypic characteristics and genetic characteristics for breeding programs. A total of 20 special purpose rice accessions were assembled and subjected to agro-morphological characterization for principal component analysis and diversity analysis. Three (3) principal components (PCs) accounted for 66.93% of the total variation. PC1 accounted for 35.7% of the total variation wherein variables correlated with the season, days to maturity, 1000-grain weight, and the number of panicles per plant. PC2 accounted for 16.5% of the total variation wherein plant height and the number of panicles was the main contributors. While PC3 accounted for 14.7% of the total variation where its variables highly correlated with the length: breadth ratio (LBR) and grain yield. The 20 plants showed moderate diversity in their morphological characteristics. The SPR was also subjected to a Potassium hydroxide (KOH) assay where 10 of the accessions were strongly scented, 5 were slightly scented and 3 were lightly scented. Molecular characterization of genes for aroma was done using allele-specific PCR assay that can identify homozygous non-fragrant and homozygous fragrant accessions. Among the 20 SPR accessions, 14 accessions were identified as homozygous fragrant accessions 6 accessions as non-homozygous non-fragrant. Therefore, the results have shown promising agro-morphological and genetic data that can be further used for rice research and special purpose rice improvement.

Keywords: special purpose rice; agro-morphological characterization; principal component analysis; KOH assay, molecular characterization

ASD-51

PHENOTYPIC AND GENOTYPIC DIFFERENCES OF SELECTED TURMERIC (*Curcuma longa* L.) MORPHOTYPES FROM THE PHILIPPINES

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Turmeric (*Curcuma longa* L.) is known as the "golden spice" because of its medicinal, economic, and ethnobotanical value. Studies on the species reveal high intraspecific variability. Particularly for pharmaceutical applications, ensuring correct genotypic identity and establishing associated traits are necessary. Characterization and evaluation were conducted for five (5) morphotypes of *Curcuma longa* L. (PBN 2019-484, PBN 2019-544, PBN 2019-576, PBN 2020-059, and PBN 2020-061) from the Philippine Biorepository Network. Delineating morphological traits were identified using a standardized descriptor list. Rhizome yield and yield components were measured. Phytochemical analysis included proximate composition, total phenolic content, curcumin content, and detection of alkaloids, saponins, flavonoids, and tannins. DNA samples were extracted and sequenced to assemble and analyze their chloroplast genomes. Variations were observed especially for plant height, coma color of the inflorescence, and rhizome color. PBN 2020-059 had the highest rhizome yield at 455.3 g per plant (59.2 metric tons per ha) but had the lowest curcumin content at 2.76 ± 0.32 mg per g sample. PBN 2020-061 was superior for curcumin content at 27.76 ± 0.53 mg per g sample and ranked third for yield at 329.9 g per plant (42.9 metric tons per ha). Flavonoids and tannins were present in all accessions, alkaloids were not detected for PBN 2020-059 and 2020-061, and saponins were not detected for PBN 2020-061. Values for crude fat, crude fiber, and crude protein showed variations. Chloroplast genome analysis revealed differences with sequence lengths ranging from 162,180 to 162,254 bp. Variations observed in the assembled chloroplast genomes support the phenotypic differences among the accessions. Potential selections were made for direct utilization as reference materials and for medicinal research, propagation, and breeding work.

Keywords: curcumin content, chloroplast genomes*, luyang dilaw*, phytochemical analysis, yield and yield components

ASD-52

SEED MORPHOMETRIC ANALYSIS OF COMMERCIALLY-CULTIVATED COFFEE IN THE PHILIPPINES

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Coffee is a valuable and widely traded agricultural commodity that generates livelihood from an estimated 12.5 million coffee farms worldwide. The Philippines is one of the coffee-producing countries with the four commercially viable coffee, namely *C. arabica* (Arabica), *C. canephora* (Robusta), *C. liberica* var. Liberica (Liberica), and *C. liberica* var. Dewevrei (Excelsa). The absence of a quick and reliable method of identifying coffee trees, coffee seedlings, and seeds results in misidentification, mislabeling, and contamination with lower-grade coffee types that can eventually lead to fraudulence in coffee marketing and trading. Using metric and geomorphometric analysis, this study was conducted to determine the potential of seed characteristics to differentiate the four types of coffee in the country.

At least 100 fruits (cherries) of thirty-one accessions representing the four types of coffee were collected and processed into parchment, seed or green coffee beans (GCB), and roasted coffee beans (RCB) and used for the genetic characterization using metric and geometric characters. The data were analyzed using ANOVA, SIMPER, Cluster Analysis, and the correlation test.

High genetic diversity was found in GCB and RCB (H'=0.82 and H'=0.74, respectively). Morphometric data showed that Liberica was found to be the most different from other coffee types. In GCB and RCB, it can be identified and differentiated by its seed size (seed volume) which is strongly correlated with seed length, seed shape index, and width-thickness ratio, length-thickness ratio and weight of 100-parchment or GCB. Most samples of Arabica can be differentiated from other coffee using GCB shape (elliptic) and ridge shape (S-shape). Robusta can be generally differentiated using ridge shape. In the geomorphometric analysis, Robusta showed a distinct ventral and cross-sectional seed shape from Arabica, Liberica, and Excelsa. The cluster analysis supports the coffee differentiation mentioned above. Two major clusters were formed, Cluster 1: the Liberica cluster; and cluster II: Arabica, Robusta and Excelsa cluster. The three types of coffee in cluster II showed distinct separation from each other.

The results of this study provide a quick, reliable, and cost-effective method of identifying coffee using GCB, a coffee form used in the majority of coffee trading.

Keywords: morphometric, green coffee beans (GCB), roasted coffee beans, parchment coffee

ASD-53

SNP GENOTYPING, AGRONOMIC PERFORMANCE AND DISEASE EVALUATION OF IMPROVED MUTANT LINES OF PHILIPPINE TRADITIONAL RICE VARIETY 'AZUCENA'

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Azucena is a Philippine traditional rice variety known for its aroma, and desirable grain and eating qualities. However, Azucena is low-yielding, lodging-prone, and late-maturing, hence Azucena is not preferred by most Filipino rice farmers. The University of the Philippines Los Baños Rice Varietal Improvement Team (UPLB-RVIT) aims to improve its yield, shorten the plant stature and hasten the maturity through mutation breeding. Gamma-irradiated Azucena seeds using Cobalt-60 at the Philippine Nuclear Research Institute were planted, and the lethal dose 50 (LD50) was established to be between 500-600 Gy. Field selection and generation advance from M1 to M7 were conducted from 2016-2019 based on early maturity, shorter stature, increased tillering ability, yield and other yield-related characteristics. A total of 22 promising advanced mutant lines were selected and evaluated in a preliminary yield trial (PYT) in the 2022 wet season. Compared to the original Azucena, 19 mutant lines had shorter plant height, 17 mutant lines had more tillers, 10 mutant lines had shorter days to heading, four mutant lines had shorter maturity, and 18 mutant lines had higher yield. Nursery screening for resistance to major diseases revealed that MON 8 had rice tungro virus resistance. The mutant lines were also subjected to trait-based genotyping using Kompetitive Allele Specific PCR (KASP) by the International Rice Research Institute (IRRI), Genotyping Service Laboratory. Quantitative trait loci (QTLs) for reproductive drought tolerance: $qDTY_{1.1}$ in MON 71; $qDTY_{12.1}$ in MON 2 and MON 71; $qDTY_{3.2}$ in 21 mutant lines; herbicide resistance (*HIS1*) in 20 mutant lines; new plant type architecture (MON 71); rice stripe virus resistance (*STV11*) in 17 mutant lines; grain zinc content (*NAS3*) in MON 6 and MON 71; anaerobic respiration (*qAG1* in four mutant lines; *qAG3* in 12 mutant lines); low chalkiness (*PGC8-2*) in MON 71, and heading date (*Hd1*) in MON 2 were detected. Further yield trials for the advanced mutant lines from the PYT will be conducted to validate data.

Keywords: Azucena, mutation breeding, mutant lines, PYT, SNP

ASD-54

TRANSCRIPTOMIC VARIANT ANALYSES BETWEEN RESISTANT AND SUSCEPTIBLE GENOTYPES REVEAL NEW INSIGHTS INTO DIFFERENTIAL RESPONSE TO BANANA BUNCHY TOP VIRUS

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Banana is considered as one of the most important fruit crops in the Philippines, as well as in other tropical and subtropical countries. Its vulnerability to various diseases, however, limits its optimal production. Banana bunchy top disease caused by banana bunchy top virus (BBTV) is an important banana disease bringing catastrophic loss to the global banana industry. In this study, transcriptome-wide variants, specifically SNPs and short InDels, between the RNA-seq data of BBTV-inoculated samples of resistant wild *Musa balbisiana* (n=3) and susceptible *Musa acuminata* Colla 'Lakatan' (n=3) were detected and screened using various bioinformatics approaches. GATK Best Practices Workflow for RNAseq short variant discovery (SNPs + Indels) were implemented to identify high-confidence variants linked to BBTV resistance in banana. Prior to variant calling, raw reads were pre-processed and aligned to *Musa acuminata* 'DH Pahang' v4 reference genome. A total of 14,459 SNPs and 5,705 InDels were detected given the RNA-seq data from susceptible 'Lakatan', and 20,605 SNPs and 3709 InDels from resistant wild *M. balbisiana*. The predicted effect and impact of these variants to overall gene function were also investigated. DNA markers targeting SNPs and InDels with high-impact effects to the genes related to pathogen response and/or resistance were designed. The results of the study provided insights into the possible contribution of structural gene variants to banana BBTV resistance. Furthermore, this study provides a novel genetic resource for establishing significant genetic association of putative R-genes to banana BBTV resistance and aiding in banana varietal improvement programs in the Philippines. (BBTV = Banana Bunchy Top Virus; SNPs = Single Nucleotide Polymorphisms; InDels = Insertions and Deletions; RNA-seq = RNA sequencing; GATK = Genome Analysis Tool Kit; DH = Double Haploid; R-genes = Resistance genes)

Keywords: bioinformatics, BBTV, RNA-seq, SNPs, InDel

ASD-55

ESTABLISHING THE SEED VIABILITY MODEL OF
RADISH (*Raphanus sativus* L.)

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Radish is a root vegetable that is primarily grown from seeds, and its germplasm is often conserved through seedbanking; however, the seed viability equation, which will predict its longevity in storage, is not yet established. Hence, we derived the K_E and C_w constants to build an effective model that will predict the ability of the seeds to germinate at different moisture content (MC) and temperature regimes. Radish seeds of cultivar 'Kaiware' were kept in hermetic storage at seven moisture levels (12.54%, 11.47%, 10.83%, 9.95%, 7.60%, 6.83%, and 6.24%) at 50 °C up to 68 days. Seed viability was assessed at scheduled intervals in the different moisture regimes. We converted the germination percentage data to probits, and subsequently calculated the log σ, the standard deviation of the distribution of seed death through time, and log MC across the moisture levels. Using these data, the K_E and C_w values were derived, using linear regression, as 6.65 and 3.44, respectively. The validity of these constants was tested by predicting seed viability loss in a different radish cultivar ('Sango Purple') through a controlled deterioration experiment at 45 °C and 8.61% MC. The observed viability loss was closely predicted by the equation (R^2 = 0.9405). This indicated that the established species constants, together with the universal temperature constants, can be used to predict accurately the storage behavior of radish seeds using critical parameters. This is the first seed viability model generated for this species.

Keywords: conservation, seed storage, seed longevity, shelf life, viability constants

BIOLOGICAL SCIENCES

CHARACTERIZATION TAGULAUAI *(Parameria laevigata (*A. JUSS) MOLDENKE*)*

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Tagulauai *(P. laevigata)* is a forest vine used in traditional medicine against common ailments in the province of Nueva Vizcaya. Leaves of Tagulauai *(P. laevigata)* from different forest sites were collected and subjected for study. Characterization was based on its authentic species identification using Deoxyribonucleic Acid (DNA) Barcodes, morphological descriptions using leaves and bark traits, ecological attributes using soil properties and climatic factors and phytochemical constituents using the present secondary metabolites and total phenol content.

Based on the results, Tagulauai *(P.laevigata)* from the five forest sites belong to one single and identical species as 100% *Parameria laevigata* voucher A.D. J. Middleton *et.al 2551* with an accession number of MF350544 from Basic Local Alignment Search Tool (BLAST) and its evolutionary relationship as reflected in the phylogeny tree and genetic distance matrix generated from the Molecular Evolutionary Genetic Analysis (MEGA). The identity of the samples are supplemented by the quantitative and qualitative description of the leaves, bark, soil properties and the environmental factors innate in the forest sites having nine (9) common constituents and mean total phenolic content of 41.23 mg GAE/kg.

Future researchers may explore further research needed to establish mechanism involved in these effects and also to isolate chemical constituents quantitatively, elucidate the mechanisms behind the biological activities and focus extensive clinical studies on the bark and leaves necessary for the development of products.

Keywords: deoxyribonucleic acid (dna) barcodes, phytochemical, characterization, Tagulauai

COMPARATIVE ANALYSIS OF tRNA GENE STRUCTURE AND ORGANIZATION IN PLANTS

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Although the gene structure and distribution of transfer RNAs (tRNAs) in prokaryotes and eukaryotes, particularly in vertebrates, yeasts, and flies, are well understood, there is a dearth of information when it comes to plants. Comparative studies on plant tRNAs are also rare, and the increasing availability of plant genomes spanning the major flowering plant lineages will enable the analyses of complete tRNA gene sets. Using the tRNA prediction tool, tRNAscan-SE, nuclear tRNAs were predicted from the genomes of 69 plants covering the major flowering plant lineages - monocots, dicots, *Ceratophyllaceae* (sister clade to dicots), and the ANA (*Amborellales*, *Nymphaeales*, and *Austrobaileyales*) clade. A detailed and comprehensive annotation and analyses of genomes from 44 dicots, 20 monocots, and five from other lineages will provide a global picture of plant tRNA gene structure and organization. Only the monocots show a good correlation between tRNA gene numbers and genome size (R^2=0.79), unlike the dicots (R^2=0.29) and those from the ANA lineage (R^2=0.05). For all the three lineages, on average, less than half of the tRNA genes per genome are unique, suggesting a high degree of duplication of tRNA genes. Screening for intron-containing tRNA genes showed that plant genomes have more than one tRNA^{Met} and tRNA^{Tyr} genes that contain introns. Alignment of these intron sequences revealed that the tRNA^{Met} introns showed a more conserved sequence in the three plant lineages (a seemingly conserved GCT and GAGT residues at the 5' and 3' ends of the introns, respectively) than the tRNA^{Tyr} introns (a seemingly conserved T and A residues at the 5' and 3' ends of the introns, respectively). Although rare, introns were also found in non-Met and non-Tyr tRNA genes. Analyses of sequences upstream of the tRNA genes showed that the upstream 50 bases are A/T-rich. From the single covariation analyses of tRNA secondary structures, the cloverleaf structure of tRNA^{Met} shows a higher degree of conservation compared to that of tRNA^{Tyr} in the three major plant lineages. These findings reveal differences and patterns acquired by plant genomes throughout evolution and can serve as foundation for further studies on plant tRNA gene function and regulation.

Keywords: transfer RNA, gene structure, gene organization

BSD-03

COMPARATIVE TRANSCRIPTOMIC ANALYSIS OF *S-ADENOSYLMETHIONINE SYNTHASE* 4 AND DEAD-BOX ATP-DEPENDENT RNA HELICASE 11 MUTANTS INFILTRATED WITH BACTERIAL ELICITOR FLG22 INDUCING PAMP-TRIGGERED IMMUNITY

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RNA-binding proteins (RBP) play a critical role in transcriptional and post-transcriptional control of gene expression which greatly affects plant metabolism and are known to contribute to the regulatory processes of plant immunity. RBPs are also directly targeted by pathogen effectors as susceptibility factors to promote disease development. Previously, the dynamic changes in RNA-binding proteome of *Arabidopsis thaliana* during immune responses to the bacterial elicitor flagellin 22 inducing pathogen-associated molecular pattern (PAMP) triggered immunity (PTI) has been profiled using the plant RNA interactome capture (ptRIC) technique. However, the precise role of flg22-responsive RBPs in RNA regulation during plant immune response needs further characterization. Knockdown mutants of two flg22-responsive RBPs, *DEAD-box ATP-dependent RNA helicase 11* (rh11) and *S-adenosylmethionine synthase 4* (metk4) were found to display increased resistance to *Pseudomonas syringae* pv. tomato and its non-pathogenic mutant *hrpA*. Further characterization of the phenotype of these mutant lines were done by performing leaf infiltration with flg22 solution and mRNA-sequencing analysis to compare flg22-responsive gene expression in these lines to wild type *A. thaliana* Col-0 at 0, 2 and 6 hours after flg22 treatment. The significant differentially expressed genes (DEGs) comparing mutants and to wild type Col-0 across time points for early and late immune response were identified and were clustered based on Z-score of gene abundance. The gene ontology terms encompassing molecular function, biological process and cellular component and enriched Kyoto Encyclopedia of Genes and Genomes (KEGG) pathways based on gene ratio generally showed activated defence-related genes and suppressed photosynthesis-related genes. This information may help in the development of novel disease control strategies through a deeper understanding of the role of RBP and cognate RNA in plant immunity and disease susceptibility to improve host plant resistance.

Keywords: RNA-binding proteins, rh11, metk4, flg22, RNA-seq

DE NOVO ASSEMBLY OF THE *Citrus hystrix* DC. S.S. CHLOROPLAST GENOME AND ITS COMPARATIVE ANALYSES WITH *C. Micrantha* WESTER

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Citrus hystrix ("kabuyaw") is closely related to *C. micrantha* ("biasong") which resulted to their current taxonomic treatment as a single species. Hence, we investigated the genotypic differences between these species through chloroplast genome assembly and comparison. We assembled and annotated the chloroplast genome of *C. hystrix*. This was then compared to the published chloroplast genome of *C. micrantha* to provide additional evidence into their species unification or delineation. The morphology of the utilized *C. hystrix* accession (ICROPS 1398) was also characterized to ensure the continued utility of the research outputs in case of future taxonomic revisions. The complete plastome sequence of the species is 159,857-bp long with 129 coding genes comprising 84 mRNA genes, 37 tRNA genes, and eight rRNA genes. Only slight variations were observed in their genome features. Significant variations were observed in 18 coding regions of the plastome that often have conserved nature. This included single nucleotide polymorphisms in *matK, rbcL, psbA, ndhF,* and *ndhA*. A phylogenetic analysis of the assembled genome, along with 27 Citrus species (in group) and 3 other Rutaceae species (sister group and outgroup), identified *C. micrantha* and *C. aurantiifolia* as the closest relative of *C. hystrix*. However, *C. micranth*a maintains a closer relationship with *C. aurantiifolia*, a natural hybridization between *C. micrantha* and *C. medica*. These denote evolutionary divergence between the plastomes of *C. hystrix* and *C. micrantha* further supporting their species delineation.

Keywords: chloroplast DNA, Illumina sequencing, Rutaceae, phylogenetic analysis

DETERMINING THE SENSITIZATION PROFILE OF GRASS AND TREE POLLEN SPECIES IN YOUNG ADULTS RESIDING IN ILOCOS NORTE USING SKIN PRICK TEST

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Pollen is a significant source of aeroallergens, which trigger allergic diseases including rhinitis, asthma, and atopic dermatitis. Despite the high prevalence of grass and tree pollen in the productive agricultural lands of the Ilocos region, there is a limited understanding of pollen allergenicity in Ilocos Norte. This study aims to determine the allergenicity and sensitization profile of young adults aged 18-26 residing in Ilocos Norte to various grass and tree pollen species through skin prick testing. Pollen content from several species of grass and tree were extracted for the allergy test. Prior to the test, volunteers underwent a clinical history interview. A panel was created on the volar aspect of the patient's forearms for pricking, and reactions were read after 15 to 20 minutes. Of the self-reported allergic diseases, 48% had allergic rhinitis, 28% asthma, and 18% atopic dermatitis. Females had a higher pollen sensitization profile compared to males. *Dichanthium aristatum*, *Eucalyptus* sp., and *Saccharum spontaneum* were the pollen species with the highest allergenicity. Based on the results of this community-based study, it can be concluded that young adults residing in Ilocos Norte are sensitized to various grass and tree pollen species.

Keywords: allergenicity, sensitization, skin prick test, pollen allergen

DNA AND LEAF GEOMORPHOMETRICS ANALYSES OF
Saurauia WILLD. (ACTINIDIACEAE) IN ZAMBOANGA DEL NORTE

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The genus *Saurauia* is among the most speciose plant taxa comprising 57 species in the Philippines. The striking similarities and minor definable characteristics of the leaf morphology often became the source of dubious and/or erroneous identification of these species. Moreover, a comprehensive understanding of its ecology and phylogeny is lacking. This study is an attempt to verify the correspondence between the leaf shape variations and DNA sequences to discriminate the 5 *Saurauia* species collected in Zamboanga del Norte. Leaf samples per species from varying elevations were collected. Soil samples and climatic data were also collected to determine the effect of these variables on the overall leaf size and shape. The leaf samples were measured using the traditional method, scanned, and converted to elliptic Fourier descriptors to determine leaf shape variations among *Saurauia* species. The genetic markers *rbc*L, *mat*K, and nuclear ITS were initially tested. However, after repeated amplification failures, the *mat*K marker was not further used. The analysis of the aligned DNA sequences of *rbcL* and nuclear ITS was carried out using the Maximum Likelihood composite method. Results revealed that the obtained DNA sequences from marker *rbc*L and nuclear ITS showed variations in the nucleotide content. The constructed phylogenetic tree strongly supports the species' delimitation including the placement of these species in the family Actinidiaceae. The leaf morphology was significantly different among species based on the results of LSI and leaf shape outline analyses. Discriminant analysis of the leaf shape outline confirmed the delimitation of species with scores relatively higher than the cut-off value. Only the temperature and soil pH were found to have a significant effect on the leaf shape but this may not be conclusive because of the low r values. Moreover, the result of the detrended canonical analysis did not reveal any relationships between the abiotic factors and leaf morphology. On the other hand, the tree topology from DNA sequences, leaf shape outline, and leaf size indices all exhibited similarity in the clustering at the species level. Finally, the Mantel test indicates a significant positive correlation between DNA sequences and leaf shape outline variations. The variations in leaf morphology specifically the leaf outline of the 5 *Saurauia* species was congruent in the molecular data sets, hence are complementary.

Keywords: *Actinidiaceae*, nuclear ITS, outline-based morphometrics, *rbc*L, species discrimination

BSD-07

EMBRYOTOXICITY AND TERATOGENIC EFFECTS OF BOTON (*Barringtonia asiatica* (L.) Kurz.) ETHANOLIC LEAF EXTRACT ON ZEBRAFISH (*Danio rerio*)

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The embryotoxicity and teratogenic effect of a mangrove plant, a medicinal herb with potential therapeutic effect such as Boton (*Barringtonia asiatica* (L.) Kurz.) leaf ethanolic extract on zebrafish embryos (*Danio* rerio) were determined in this study. Embryotoxicity and abnormal development of boton ethanolic leaf extract (BELE) showed that all of the three concentrations at 125, 250, 375 μg/ml recorded different developmental endpoints for a period of 120 hours.

Effect of the extract was severe at higher concentrations which include mortality, delayed hatchability, and high heartbeat rate.

Zebrafish Embryo Developmental Toxicity Assay (ZEDTA) revealed that at the end of the five (5) days (120 hours) evaluation period, toxic effects were observed such as egg coagulation, delayed hatching, heartbeat rate, and blood clotting at yolk sac while developmental deformities include lack of somites, tail malformations, coagulation of embryos, scoliosis, and head malformation.

Results revealed that plants having therapeutic potential could also pose threats when consumed at higher doses especially on the embryos. Therefore, detailed toxicity analysis carried out on medicinal plants to ascertain their safety on the embryos and its development may lead to other possibilities where *B. asiatica* may serve as a possible target for future drug development.

Keywords: *Barringtonia asiatica,* boton, embryotoxicity, teratogenic, developmental abnormality

BSD-08

INFLUENCE OF BINAHIAN (*Breynia androgyna* L.) ETHANOLIC LEAF EXTRACT ON *Allium cepa* ROOT MERISTEM

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Some medicinal plants used by people today may have detrimental effect, thus, it is important to analyze their components and effects in cells and genes. This present study aimed to assess the cytotoxicity and genotoxicity of the ethanolic leaf extract of *Breynia androgyna* L., a local medicinal plant, using *Allium cepa* L. test. Phytochemical analysis was performed on the leaf ethanolic extract of the plant, where the extract was diluted into different concentrations and served as the treatment groups. Six groups of onion bulbs were submerged into different treatment groups for two days and the morphological effects of the treatment were observed and documented. Onion roots were harvested and fixed for microscopic observation of the mitotic index and chromosomal aberrations. Results showed that the *B. androgyna* contains phytochemical compounds such as alkaloids, flavonoids, phenolics, steroids, and tannins. *Allium cepa* test revealed that there is a significant difference in the onion root length when submerged to *B. androgyna* extract in comparison with the negative control group. Thus, there is a significant inhibition of mitotic activity in the onion group treated with plant extract. On the other hand, the inhibition of the mitotic activity was highly significant in 750 µg/mL and 1000 µg/mL *B. androgyna* plant extract. One thousand µg/mL *B. androgyna* plant extract decreases mitotic index at 32% which signifies that it has sublethal effects in an organism. The number of chromosomal aberrations increases as the level of concentration of plant extract increases. There were statistically significant differences at all the values except for 250 µg/mL *B. androgyna* extract concentration and 500 µg/mL *B. androgyna* extract concentration. The plant can be utilized as food, however, if the leaves are consumed or applied at certain doses, may induce a cytotoxic and genotoxic effect in an organism.

Keywords: *Allium cepa* test, chromosomal aberrations, ethanolic extract, mitotic index

BSD-09

PHYTOCHEMICAL SCREENING, ANTIOXIDANT ACTIVITY, AND CYTOTOXICITY OF LEAF AND RHIZOME CRUDE EXTRACTS OF *Alpinia* CF. *Brevilabris* COLLECTED IN LUINAB, ILIGAN CITY, LANAO DEL NORTE, PHILIPPINES

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Overharvesting has placed many medicinal plants at risk of resource exhaustion and species extinction therefore, knowledge of the sustainable use and formulation of harvesting practices of these plants are deemed necessary. The leaves and rhizome of the plant species with a preliminary identification of *Alpinia* cf. *brevilabris* were collected in Luinab, Iligan City, Lanao del Norte, Philippines and subjected to the determination of their bioactive compounds through phytochemical screening of their crude extracts, assessment of their antioxidative capacity through 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging method, and evaluation of their cytotoxicity through brine shrimp lethality test (BSLT). The results of the phytochemical screening revealed that the leaves of the plant possess flavonoids, steroids (2-deoxy sugar), alkaloids, and saponins while the presence of flavonoids, steroids (2-deoxy sugar), alkaloids, saponins, and tannins was detected in its rhizome. The data of the DPPH assay shows that the crude extracts of the leaves and rhizome of the plant have moderate antioxidant activity with IC50 values of 61.2 μg/mL and 75.1 μg/mL, respectively. Moreover, the leaves and rhizome were found to be moderately cytotoxic with LC50 values of 105 μg/mL and 178 μg/mL, respectively. With these results, the leaves appear to be more potent compared to the rhizome as it displays more antioxidative activity and is more cytotoxic than the rhizome of the plant. Since whole-plant harvesting is more destructive than leaf, flower, and bud collection, the information derived herein can provide an idea of the conservation and management of this plant and a preliminary scientific basis for its suggested medicinal value.

Keywords: bioactive components, 2,2-diphenyl-1-picrylhydrazyl, brine shrimp lethality test

BSD-10

PHYTOCHEMICALS, ANTIBACTERIAL ACTIVITY, AND TOXICITY OF
Tabernaemontana pandacaqui POIR. FRUIT ETHANOLIC EXTRACT

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Medicinal plants have been the subject of recent drug discovery research due to its several bioactive compounds. *Tabernaemontana pandacaqui* Poir., an endemic plant species from the east and southeast Asian countries is among the traditionally used medicinal plants in the Philippines. There is still limited literature about the phytochemicals and bioactivity of the *T. pandacaqui* fruit thus, phytochemical screening and evaluation of the bioactivities of ethanolic fruit extract of *T. pandacaqui* was conducted. Standard Qualitative Tests were employed for screening of phytochemical groups, Disc Diffusion Assay for antibacterial activity against *Bacillus subtilis*, *Enterobacter aerogenes*, *Enterococcus faecalis*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and *Staphylococcus epidermidis*, and Brine Shrimp Lethality Assay for toxicity. Alkaloids, glycosides, saponins, sterols, and tannins were detected in the *T. pandacaqui* fruit extract. The 100% extract was the most effective concentration against *B. subtilis* and *S. epidermidis*, 75% extract to *E. faecalis*, *P. aeruginosa*, and *S. aureus*, 50% extract to *E. aerogenes*, and 50% to 75% to *E. coli*. The obtained LC_{50} of *T. pandacaqui* fruit extract was 140.28 ppm and was classified as medium toxic. The antibacterial activity and toxicity exhibited by *T. pandacaqui* fruit could be attributed to the phytochemicals detected in the extract particularly alkaloids, saponins, and tannins. In conclusion, *T. pandacaqui* fruit was a promising source of antibacterial compounds against a wide range of bacteria and could be a good source of potent cytotoxic compounds.

Keywords: bioactive compounds, lethal concentration, medicinal plant, zone of inhibition

BSD-11

TAXONOMY AND CONSERVATION OF THE GENUS *Cryptocoryne (Araceae)* IN THE PHILIPPINES

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Citizen scientists have advanced science for hundreds of years, contributed to biodiversity documentation, and species discovery, and even published many peer-reviewed articles in the Philippines. This is very beneficial for the Philippines, given that progress in documenting the Philippine flora is hampered by a lack of alpha taxonomic studies and herbarium specimens. Such is the case for the genus *Cryptocoryne* which is still poorly known in the Philippines, thus, this study was initiated to achieve the following objectives: 1) provide a verified list of Cryptocoryne species present in the archipelago; 2) conduct IUCN conservation assessments for them; and describe any new species discovered. A combination of literature review, herbarium examination and current fieldwork revealed nine (9) *Cryptocoryne* accepted species in the Philippine archipelago of which eight (8) are endemic. These include three new endemic species described and the identity of *C. pygmaea* has been clarified and resolved. In addition, we provided the IUCN conservation assessment for these seven species (2 Data Deficient, 1 Least Concern, 1 Nearly threatened, 3 Endangered, 2 Critically endangered). This project aims to support future taxonomic revision and phylogenetic studies of *Cryptocoryne*. It will also help define and refine conservation policies in the Philippines to offer better protection for these narrowly endemic species. Furthermore, the study highlights the importance of citizen science and the need for their engagement in exploring and conserving our Philippine biodiversity.

Keywords: aquatic plant, aroid, endangered, Philippine biodiversity, plant taxonomy, Zamboanga peninsula flora.

BSD-12

TRADITIONAL USES, PHYTOCHEMICAL SCREENING, ANTIOXIDANT ACTIVITY, AND CYTOTOXICITY OF *Ficus septica* BURM. F. ETHANOLIC FRUIT EXTRACT

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This paper presents the traditional uses, bioactive compounds present through phytochemical screening, antioxidative capacity through 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay, and cytotoxicity potential through brine shrimp lethality test (BSLT) of *Ficus septica* Burm. F. Ethnobotanical survey was done through informal interviews using a semi-structured questionnaire conducted in Plaridel, Misamis Occidental, Philippines, participated by thirty (30) key informants (ages 45-81 years old) such as senior citizens and traditional healers or practitioners. Leaves were the most widely used plant part and are prepared either for oral or external application. The most common method for preparing the medicinal plant was poultice and decoction. Headaches, body malaise, flatulence, warts, and vertigo were the most common health problems treated by the identified medicinal plant. The presence of bioactive compounds such as alkaloids, flavonoids, saponins, and steroids was determined. Data suggest that the ethanolic fruit extract exhibits weak antioxidant activity, with an IC50 of 353 ug/mL. Furthermore, the results indicate that the sample is highly toxic, with LC50 of 23.44 ug/mL. The overall information obtained here provides a preliminary scientific basis for the existing ethnobotanical knowledge of the local communities.

Keywords: traditional healers, ethnobotanical, semi-structured questionnaires, health problems

BSD-13

BIODEGRADATION ACTIVITY OF BIOMASS INDIGENOUS FUNGI (BIF) USING NIPA (*Nypa fruticans* WURMB) FROND BIOMASS UNDER SOLID-STATE FERMENTATION

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The high cost of ligninolytic and cellulase enzymes is a key stumbling block to cost-effective lignocellulosic biomass to ethanol conversion. Several efforts were done to isolate, characterize, identify and screen lignocellulolytic fungi from various ecological niches with the potential in degrading the lignocellulosic structure of biomass to produce cellulosic ethanol at a lower cost. This effort led to the screening and identification of four (4) fungi isolates with cellulolytic and ligninolytic activities namely: DCT1, WL4, ARA, and MW. A confirmatory experiment should be performed to assess the potential of the identified fungi as a biological agent for cellulosic ethanol production and other biotechnological processes. Thus, the molecularly identified biomass indigenous fungi (BIF) were evaluated to determine their biodegradation activity and their efficiency in producing cellulosic ethanol using bark and bark-free nipa (*Nypa fruticans* Wurmb) frond biomass as a feedstock. Three (3) bioprocessing pretreatments for lignocellulosic biomass were done (physical, biological, and mechanical treatment). Moreover, delignification (D), glucose conversion efficiency (GCE), and fermentability of glucose to ethanol or its ethanol conversion efficiency (ECE) were assessed. The fungi DCT1 significantly shows higher biodegradation activity using bark nipa frond biomass in one (1) month incubation period (D: 36.25%, GCE: 29.58%, ECE: 45.95%). Meanwhile, fungi WL4 using bark-free nipa frond biomass (D: 34.42%, GCE: 30.46%, ECE: 55.15%) significantly gave higher biodegradation activity compared to the other BIF after one (1) month incubation period. Results suggest that fungi DCT1 and WL4 are efficient in degrading the lignocellulosic components and can be used as a biodegradation agent when using bark and bark-free nipa frond biomass as feedstock, respectively. Hence, these two fungi strains could be promising candidates for the efficient bioprocessing of lignocelluloses.

Keywords: biodegradation activity, biomass indigenous fungi, nipa frond biomass, solid-state fermentation

BSD-14

BIOFILM INHIBITORY ACTIVITIES OF GUT BACTERIA ISOLATED FROM PACIFIC WHITE SHRIMP (*Penaeus vannamei* BOONE, 1931) AGAINST ACUTE HEPATOPANCREATIC NECROSIS DISEASE (AHPND)-CAUSING *Vibrio parahaemolyticus*

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Shrimp is an indispensable aquaculture commodity in the Philippines as well as in the international market. However, the emergence of diseases such as Acute Hepatopancreatic Necrosis Disease (AHPND) caused by *Vibrio parahaemolyticus* through a plasmid-encoded toxin, drastically decreased shrimp production, resulting in economic losses among our farmers.

Here, we report the biofilm inhibitory activities of the crude filtrate and methanolic extracts from *Penaeus vannamei* gut bacteria against Acute Hepatopancreatic Necrosis Disease (AHPND)-causing *Vibrio parahaemolyticus*.

The gut bacteria were isolated from adult *P.vannamei* using serial-dilution and spread-plate methods in Marine Agar. The gut bacteria were identified using conventional biochemical tests, Analytical Profile Index (API) 20NE kits, and 16S rRNA gene sequencing. Probable identities of the gut bacteria were *V. parahaemolyticus*, *V.tubiashii, V.campbellii* and *S.algae*.

To determine the biofilm inhibitory activities of the crude filtrate and methanolic extracts from *P.vannamei* gut bacteria, a microtiter plate-based assay following the protocol by O'Toole (2011) was done. Crude filtrates from *V.parahaemolyticus, V.campbellii,* and *S.algae were* able to inhibit biofilm formation in AHPND-causing *V.parahaemolyticus* (percent biofilm inhibition= 20-60%). Crude filtrates from *S.algae* at pH of 4-8 resulted in higher percent biofilm inhibitions of 63-69%. It was also thermostable, retaining biofilm inhibitory activity after treatment to 50-121^{0}C. On the other hand, crude methanolic extracts from *P.vannamei* gut bacteria were also able to inhibit biofilm formation in AHPND-causing *V.parahaemolyticus* at different concentrations. Specifically, *V. parahaemolyticus* crude methanolic extract exhibited percent biofilm inhibitions of 6-57%, *V.tubiashii* at 6-57%, *V. campbellii* at 25-30%, and *S. algae* at 5-24%. Thin Layer Chromatography (TLC) and color reactions using spray-reagents revealed the presence of alkaloids, flavonoids, and phenols from the crude methanolic extracts of all the gut bacteria.

The crude filtrate and methanolic extracts from *Penaeus vannamei* gut bacteria were able to inhibit biofilm formation in AHPND-causing *Vibrio parahaemolyticus*. We showed that bacteria isolated from the gut of *Penaeus vannamei* are capable of producing beneficial compounds which could be utilized against biofilm formation of pathogenic bacteria such as *V.parahaemolyticus*.

Keywords: biofilm, gut bacteria, shrimp, AHPND, Vibrio *parahaemolyticus*

BSD-15

CLASSICAL TAXONOMY COMPLEMENTED WITH TARGETED METABOLOMICS: EFFICIENT IDENTIFICATION TOOLBOX TO IDENTIFY PREVIOUSLY UNDESCRIBED PHILIPPINE *Hypoxylon* SPECIES

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Hypoxylon Bull. is the largest genus of the fungal ascomycete family of Xylariaceae with over 170 identified species. It is cosmopolitically distributed with highest diversity in tropical and subtropical areas and remains to be one of the many untapped sources of fungal natural products. Most species of *Hypoxylon* have been identified using a combination of teleomorphic and anamorphic characters together with chemosystematics through detection of stromatal pigments as they are valuable for recognizing associations between species, species groups, and genera. Information on the diversity of *Hypoxylon* species in the Philippines is limited and have been described up to genus level only. In this study, stromata of four *Hypoxylon* species collected in Mount North Tetas de Santa, Ilocos Province were identified using morpho-anatomic and molecular phylogenetic methods along with targeted liquid chromatography-high-resolution electrospray ionization mass spectrometry (LC-HRESIMS)-based chemotaxonomic analysis to identify the samples up to the species level. Biological assays to assess their anti-inflammatory, antitubercular and cytotoxic activities using reporter and whole-cell assay methods were also performed. Thus, stromata on infected woods (*Tamarindus indicus*, *Gliricidia sepium*) and their corresponding oatmeal plate cultures were analyzed using morpho-anatomical techniques and found to specifically relate to characteristics of *Hypoxylon* species. Molecular analysis results identified four previously unreported *Hypoxylon* species in the Philippines namely *H. anthochroum*, *H. fragiforme*, *H. griseobrunneum*, and *H. pullicidum* after analysis of Internal Transcribed Spacer (ITS), Large Subunit (LSU) rRNA and β-tubulin sequences. Some of these species have been previously reported only in pan-tropical countries. Targeted LC-HR-ESIMS analysis showed the presence of species-specific secondary metabolites such as azaphilones (such as daldinin E and daldinin F), mitorubrins, and aromatic polyketide phenolics such as binaphthalene tetrol (BNT) in the stromatal extracts further supporting their species level identification. Bioassay results of the submerged yeast-malt-glucose culture extracts of *H. griseobrunneum* revealed moderate anti-TB activity (MIC versus *Mycobacterium tuberculosis* $H_{37}Rv$ = 31.75 ug/mL), antiproliferative activity against chronic hmyolegenous leukemia cells, K-562 (GI_{50} = 34.6±0.6 ug/mL), and HeLa (CC_{50} = 39±0.8 µg/mL), and moderate activation of nuclear factor-erythroid factor 2 (NrF2) in Huh cells. Our work records for the first time the occurrence of these four *Hypoxylon* species in the Philippines and highlights pioneering attempts to explore their chemical, biotechnological and medicinal potentials.

Keywords: *Hypoxylon,* morphological analysis, molecular phylogenetics, chemosystematics, biological activity

BSD-16

EFFECTS OF TALISAY (*Terminalia catappa* L.) LEAF EXTRACT ON BIOFILM FORMATION, VIBRIOSIS AND GENE EXPRESSION IN *Penaeus vannamei* SHRIMP POSTLARVAE AND ITS POTENTIAL AS A FEED SUPPLEMENT

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The shrimp aquaculture industry, including that of the Philippines, is constantly under threat by disease outbreaks such as those caused by *Vibrio* spp. Finding alternative measures to the regular use of antibiotics to combat these outbreaks is crucial in order to prevent billions of production losses while avoiding contributing to antimicrobial resistance. In this work, the potential of ethanolic leaf extracts of talisay (*Terminalia catappa* L.), a plant native to the country, as a feed additive was investigated by screening and determining its effects on (1) biofilm formation, an essential mechanism in the pathogenesis of vibriosis, (2) the growth and survival of *Vibrio*-infected and uninfected whiteleg shrimp (*Penaeus vannamei*) postlarvae in *in vivo* assays, and (3) the expression of immune-related genes of shrimp (prophenoloxidase (proPO), superoxide dismutase (SOD), transglutaminase (TGase), lectin, lysozyme, and penaeidin). Results showed that although biofilms were not inhibited from forming, the biofilms formed by *V. parahaemolyticus* were susceptible to dispersal upon treatment with talisay extract. During pre-infection tests, the talisay extract did not negatively affect shrimp growth and survival rates. *In vivo* assays revealed that shrimp given talisay-supplemented feed recorded higher survival rates upon infection with either the reference strain *V. parahaemolyticus* ATCC17802 (93%) or the acute hepatopancreatic necrosis disease (AHPND) strain *V. parahaemolyticus* R1 (77%) compared with the ATCC17802- and R1-infected shrimp given un-supplemented feed (i.e. without talisay; control group) which recorded 23% or no surviving shrimp, respectively. After feeding the shrimp for 14 days with talisay-supplemented feed, proPO, SOD, TGase, and lysozyme genes were upregulated, while lectin and penaeidin genes were both downregulated. These data suggest that *T. catappa* extract may be a good candidate as a feed supplement since it attenuated biofilms formed by *V. parahaemolyticus* ATCC 17802 and R1, had no negative effects on shrimp growth and survival, and offered protection from AHPND infection. Moreover, the resulting differential expression of immune-related genes upon feed supplementation with talisay indicate *T. catappa* may be explored as a solution to boost shrimp immunity prior to infections.

Keywords: AHPND, immunomodulation, *Penaeus vannamei, Terminalia catappa*, *Vibrio*

BSD-17

EMERGING RECORDS OF TOXIN-PRODUCING CYANOBACTERIA Dolicosphermum AND Planktothrix IN LAKE CALIBATO, SAN PABLO LAGUNA PHILIPPINES

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Toxin-producing cyanobacteria posed a threat to freshwater biodiversity, emergence of these toxin producing microbes are due to increase in temperature, CO_2 consumption, increased in nutrients inputs and global related changes. Climate driven impact has cause nuisance blooms in freshwater ecosystem that cause fish kills globally. Severe health, ecological and economic may have an impact on the community that resides in the 7 Maar Lakes. Certain phytoplankton such as the group of Cyanobacteria may have physiological behavioral and ecological traits that produce blooms and toxin through an ecological trade off may exist in variation of multiple environmental stressors (Nutrient, Temperature, Light shifts and Carbon shift. Field sampling was done during dry (May) and wet (August), toxin producing cyanobacteria were collected at various stations: Fish Cages, Limnetic, near Littoral Vegetation and Littoral Household. Counting and identification was done through light microscopy, to assess the various morphological feature. An increase of cyanobacteria was accounted for Microcystis either toxic or non-toxic were it was found common bloom forming in all 7 Lakes. Increase population of Dolichospermum and Planktonthrix were found in Lake Calibato at Limnetic station during dry season. Limited population of Planktonthrix was present in Lake Palapakin during wet season this was due to high wind and mixing of water column. Presence of possible new records of these two toxin producing cyanobacteria within the taxon *Planktonthrix* and *Dolichosphermum* were found both in Lake Calibato while Planktonthrix was found in Lake Palakpakin. Taxonomic analysis shows general characteristics of *Dolichospermum which are* cells are dark brown and appear granular or mottled due to gas vesicles in the cells, and may characterized to filaments can be straight, bent, coiled, or irregularly twisted, and may be solitary or aggregated into tangled clumps. In contrast, *Planktonthrix* have no heterocyst and no akinetes. *Planktonthrix* are unique because they have trichomes and contain gas vacuoles unlike typical planktonic organisms. These reported toxic producing have various ecological niche, *Dolicosphermum* prefer warm, calm weather in lakes and ponds with relatively high nutrient concentrations, while *Planktonthrix* depending on species prefers low light conditions, and can tolerate mixing in the water column. Emergence of these possible new records may an indicator that we need to further investigate and continuous monitoring of nuisance bloom of cyanobacteria in the tropical region such as the Philippines, as these may negatively impact the sustainability and management of 7 Maar Lakes.

Keywords: toxin-producing cyanobacteria, lakes, climate-driven shift, lakes

BSD-18

LOW-DENSITY POLYETHYLENE (LDPE) AND POLYLACTIC ACID (PLA) – DEGRADING BACTERIA ISOLATED FROM A LANDFILL IN BRGY. BAROBO, VALENCIA CITY, BUKIDNON

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Plastic wastes have significantly accumulated in the environment, posing an alarming ecological threat. Isolating microorganisms capable of degrading plastic wastes from landfills is unexplored, mainly in the Philippines. This study aimed to isolate and identify bacteria in a landfill in Valencia City, Bukidnon, potentially degrading Low-Density Polyethylene (LDPE) and Polylactic Acid (PLA) plastics. LDPE and PLA - degrading bacteria were isolated from the soil samples. The isolates designated as LDPEDB11 and PLADB1 were Gram-negative, coccobacillus, motile, catalase-positive, and citrate-positive bacteria. Significant changes in turbidity of LDPE plastics by measurement of its OD_{600} indicates that LDPE degradation is taking place. Several punctures on the PLA Film by PLADB1 were observed after 14 days of incubation, and a clear zone around the colonies was observed using phase contrast microscopy, indicating PLA degradation activity. Both isolates were subjected to colony PCR; however, only the amplicons of PLADB1 were successfully obtained. The identity of PLADB1 was determined by 16S rRNA gene sequencing and was identified to be under a recently established genera *Pseudocitrobacter*; however, due to its low discrimination, the species epithet was not identified, and data on the plastic-degrading abilities of the *Pseudocitrobacter* genera is insufficient. From the findings obtained, it is clearly understood that the bacterial isolates obtained from a landfill in Valencia City, Bukidnon have the potential to degrade plastics, particularly Low-Density Polyethylene and Polylactic Acid as its carbon source for metabolism.

Keywords: LDPE, PLA, plastic, plastic-degrading bacteria, *Pseudocitrobacter*

BSD-19

MICROBIAL CHARACTERIZATION OF DIFFERENT STAGES OF WASTEWATER TREATMENT IN A POULTRY FARM USING 16S rDNA REGION METABARCODING

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Wastewater treatment systems heavily rely on functional microorganisms, especially on the activated sludge, for the removal of pollutants and nutrients. However, information on the identities and functions of these microorganisms are few and limited in the Philippines. This study aims to assess the bacterial community composition in different treatment stages of a poultry farm wastewater treatment plant. Briefly, influent, activated sludge, and effluent were sampled, and DNA extraction was performed. DNA extracts were sent to a sequencing facility for 16S rDNA amplicon sequencing targeting the hypervariable regions V1 to V3. Bioinformatics analyses was done using operational taxonomic units (OTUs). Analyses showed that Proteobacteria dominated all treatment sites. Actinobacteriota was the second most dominant phyla in the activated sludge while it was Bacteroidota for the influent and effluent samples. In terms of diversity in species level, *Aquaspirillium* uncultured bacterium, *Tepidibacter* uncultured bacterium, family Comamonadaceae member, Order Campoylobacterales member, and Arcobateraceae members were some of the dominant species in the influent. For activated sludge, a class Actinobacteria member, a domain Bacteria member, an order Rhizobiales member, *Lapillicoccus* uncultured bacterium, and a family Rhizobiaceae member are most dominant. For effluent, *Delftia sp.* is significantly dominant at 38-42% abundance. A family Comamonadaceae member, a Domain Bacteria member, *Flavobacterium*, and an Order Campylobacterales member are the other dominant species. However, there were many OTUs that were unidentified using SILVA-138. Alpha diversity indices such as Shannon's diversity and Chao1 showed that bacterial diversity and richness were highest in the activated sludge, followed by the influent, and then the effluent. Beta diversity indices such as Bray-Curtis index, Jaccard's distance, and UniFrac distances showed that each sample type represented distinct microbiomes apart from each other. OTU clustering using different methods showed that the microbiome of the effluent and influent were more similar with each other compared to the activated sludge. The findings suggest the activated sludge microbiome is distinct and highly diverse from other treatment stages, which may be associated with the extensive biological processes needed for wastewater treatment.

Keywords: metabarcoding, wastewater, poultry farm, microbiome

BSD-20

MYCELIAL GROWTH PERFORMANCE OF COMMERCIAL STRAIN OF *Pleurotus cystidiosus* ON CORN-BASED SUBSTRATE

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Pleurotus cystidiosus is an edible basidiomycetes commonly food growing on rotting logs during rainy season. In this study, the mycelial growth performance of commercial strain of *P.cystiodiosus* on three varieties of corn used as a culture media and the influence of the physical factors (pH, aeration, illumination and temperature) and spawn material were determined in order to develop practical production technology. Among the three varieties of corn evaluated, the secondary mycelia grew best on sweet corn decoction gelatin as indicated by faster mycelial growth at pH level of 6.0 under the alternating light and dark condition at room temperature. Among the cracked corn spawn materials, the rapid and luxuriant mycelial growth of *P. cystidiosus* for the mother spawn was able to grow in the cracked yellow corn.

Keywords: mycelial growth, *Pleurotus cystidiosus*, physical factors, corn-based

MYCELIAL GROWTH PERFORMANCE OF *Volvariella volvacea* IN TARO (*Colocasia esculenta)* PEELS AND CORN (*Zea mays)* HUSK AS ALTERNATIVE CULTURE MEDIA

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Taro (*Colocasia esculenta*) is a tropical herbaceous plant and one of the most nutritious and easily digested food. Corn (*Zea mays*) is a starchy vegetable that comes as kernels on a cob, covered by a husk. Taro peels and corn husks are agricultural wastes that can be used as alternative culture media because of its starch and fiber content. On the other hand, Paddy Straw Mushroom (*Volvariella volvacea*) or locally known as Kabuteng saging is a mushroom species known for its health and livelihood benefits. This study aims to determine the mycelial growth performance of *V. volvacea* in taro peels and corn husk culture media. Taro peels and corn husk media were obtained through the process of decoction and extraction. The decocted taro peels and extracted corn husk were formulated to produce different concentrations. One liter of tap water, 20 grams of gulaman bar, and 10 grams of white table sugar were added to each treatment to produce the culture media. For sterilization, the media was autoclaved for 20 min at 121◦C at 15 psi. Factorial in Completely Randomized Design (CRD) was employed in setting up the treatment that was replicated thrice. At an average temperature of 26.95°C and 37.98% relative humidity, *V. volvacea* showed the highest mycelial run in T2 – 100% taro peels compared to other treatments. The T2 – 100% taro peels and T6 – 100% corn husk had the thickest (++++) mycelial density among all evaluated media. Meanwhile, T2 – 100% pure taro peels and T3 - 75% taro peels and 25% cornhusk generated the shortest time of incubation. Among the media tested, the T2- 100% taro peels is the ideal alternative culture media for *V. volvacea* mycelial production because it has shortest number of days of incubation for full ramification and the thickest mycelial density.

Keywords: *Volvariella volvacea, Colocasia esculenta, Zea mays,* mycelial growth performance, culture media

BSD-22

OPTIMIZATION OF LIQUID CULTURE CONDITIONS AND BIOACTIVITY OF WILD PHILIPPINE MUSHROOMS

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The Philippines is a rich source of mushroom species with promising nutritional and pharmacological potentials. However, solid-state cultivation is not suitable for all mushroom species. In this study, the mycelial biomass production of ten wild mushrooms was evaluated in submerged conditions. The optimum nutritional and physical factors were based on the biomass yield after seven days of incubation and the potential bioactivity of the mycelial extracts were evaluated. Mushrooms have varying responses to nutritional and physical factors. Five mushroom species grew best in rice bran broth while the other five preferred potato sucrose broth. *Xylaria hongkongensis* produced the highest yield (136.33 mg/30ml). *Cyclocybe cylindracea*, *Polyporus grammocephalus,* and *Oudemansiella canarii* have specific pH preferences. *Pycnoporus sanguineus* is not pH sensitive while the rest of the species produced high yields in a wide range of pH concentrations. The majority of the mushrooms preferred 28°C except for *Pleurotus nebrodensis* which prefers 21°C. Light has a positive impact on the biomass production of *C. cylindracea*, *P. sanguineus* and *Cyathus* species. *P. nebrodensis* grew best in the dark while the other species did not show light sensitivity. Agitation favored the growth of *Cyathus* sp. *O. canarii, P. nebrodensis, P. sanguineus,* and *X. hongkongensis*. *C. cylindracea* and *P. giganteus* preferred static conditions while three of the mushrooms were not affected by agitation. The extracts showed distinct zone of inhibition against *S. aureus*. Among the ten extracts, *X. hongkongensis* recorded the highest diameter zone of inhibition (11.93 mm) followed by *Cyathus* sp. (11.27 mm) whereas *P. giganteus* had the lowest diameter zone of inhibition (6.77 mm). *E. coli* showed sensitivity to *X. hongkongensis* (6.97 mm) and *O. canarii* (6.76 mm) extracts. The hatchability of embryo is greatly affected by the extracts wherein high concentrations can cause lethal effects. Growth retardation was the most noticeable teratogenic effect of the extracts after 48 hours. Therefore, all mushroom species can be cultivated in submerged conditions wherein a high yield can be obtained when provided with the optimum conditions. The ethanolic mycelial extracts of these mushrooms could be a valuable resource for antimicrobial and anticancer compounds that need to be isolated, characterized, and identified.

Keywords: mycelial biomass, submerged cultivation, antibacterial, teratogenic

BSD-23

PLASMID CONFERS AND MEDIATES SPREAD OF MULTIDRUG RESISTANCE GENES IN ENTEROBACTERIAL SPECIES ISOLATED FROM PHILIPPINE NATIVE CHICKEN

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Multidrug resistant (MDR) enterobacterial species, specifically one that showed resistance to 11 antibiotic classes, were previously isolated from the Philippine native chicken Joloanon raised at a national swine and poultry research and development center, which provides native chicken breeds to local farmers as potential source of income. The detection of multidrug-resistant strains suggests the presence of antimicrobial resistance (AMR) genes in the farm, which can be transmitted to naive animals, humans, and other farms. One mode of acquisition of AMR genes is via horizontal gene transfer (HGT) involving conjugative plasmids and transposons. In this study, the antibiotic resistome of the plasmid harbored by the MDR isolate from the Philippine native chicken Joloanon was determined, to gain insight into the mechanisms and transmission of the AMR phenotypes. The plasmid was sequenced by Illumina platform and the raw sequences were assembled using SPAdes v.3.13.1 command line. Annotation of AMR genes using CARD-RGI v.3.1.4, v.5.2.0 revealed the presence of ten (10) AMR genes in the plasmid, including *dfrA12, QnrS1, aadA2, AAC(3)-IId, sul1, sul2, APH(6)-Id, APH(3")-Ib, dfrA14* and *qacEdelta1*. These AMR genes confer resistance to six (6) classes of antibiotics, including sulfonamide, diaminopyrimidine, fluoroquinolone, aminoglycoside, quinolone, and folate pathway inhibitor via any of the following fundamental mechanisms: antibiotic target replacement, antibiotic target protection, antibiotic inactivation, and antibiotic efflux. By using IS Finder tool, autonomously mobile genetic elements were also detected in the plasmid, such as several insertion sequence (IS) elements with origins from *Escherichia* sp., *Salmonella* sp., *Shigella* sp., *Klebsiella* sp., *Proteus* sp., *and Salmonella* sp. Several transposons belonging to the Tn3 family transposases were also annotated, namely, TnAs1, TnAs3, and ISKox2. Members of the Tn3 family, which are replicative transposons, have been notorious for their contribution to the distribution of antibiotic resistance and the emergence of MDR pathogens worldwide. The IS elements and transposons found in the plasmid can therefore potentially contribute to mobilizing the AMR genes, enabling rapid spread among microbial populations and in the farm. Furthermore, the plasmid harbors VirB (virulence regulon transcriptional activator), which activates the transcription of the virulence factors, contributing to pathogenicity of the host bacteria. The results of this study illustrate the presence and potential transmission of various AMR genes in the farm where the native chicken is raised, highlighting the need for antimicrobial stewardship and infection control programs.

Keywords: multidrug resistance, native chicken, plasmid

BSD-24

POLYPHASIC PROFILING OF CELLULAR SLIME MOLDS OF LA UNION, PHILIPPINES: SYNECOLOGY, MORPHOGENESIS, AND SPATIAL MACHINE LEARNING PREDICTIONS

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Philippine studies on slime molds have been gaining much increasing popularity in recent years, yet there is much to be done on the matter of its inclusivity as dictyostelids have largely been overlooked. Not to mention, the country has very few studies that investigate this category of microbial predators over the past two decades despite their ecological importance in maintaining balance in the soil ecosystem. Thus, we consolidated a multifaceted assessment to examine various properties of locally isolated dictyostelids which allots characterizations based on their [1] diversity and ecological patterns, [2] predictive spatial profile, and [3] responses to controlled simulations based on light- and food-induced conditions. Herein, a total of ca. 10 morphospecies of dictyostelids were recovered from soil samples collected in two terrains in San Fernando, La Union, Philippines following cultivation in Hay Infusion Agar (HIA) wherein the clonal count of each clear-cut morphospecies was calculated to serve as bioindicator of the ridge to reef management for the municipality. The most abundant species, *Dictyostelium discoideum* was then spatially modeled for the first time using machine learning predictions via MaxEnt and revealed that bioclimatic factors such as diurnal range and precipitation contribute significantly to the possible distribution of the species. Moreover, the morphogenesis of *D. discoideum* was observed by setting-up three experimental bioassays: (I) phototaxis, (II) effect of light wavelengths, and (III) prey viability. Our set-ups revealed the following: (I) photoavoidance is more of a random preference, (II) slugs develop in any type of light wavelength but fructification is fastest in white ambient light conditions, and (III) dead microbial cells are the less preferred food source for the development of a complete dictyostelid life cycle. This study reports the first (i) isolation of dictyostelids that compared upland versus coastal soils of the Philippines, (ii) mapping and modeling of spatial occurrence, and (iii) utilization of simple bioassays to understand the ecophysiology of locally isolated dictyostelids.

Keywords: eumycetozoans, maximum entropy, microbial development, protist, social amoebae

BSD-25

STARTER CULTURE POTENTIAL OF INDIGENOUS ACETIC ACID BACTERIA AND LACTIC ACID BACTERIA FROM WET FERMENTATION OF ARABICA (*Coffea arabica* L.) COFFEE CHERRIES

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Fermentation is a crucial step in producing a better cup quality of coffee with unique flavor and aroma. This process is primarily driven by indigenous fermentation microbes, such as acetic acid bacteria (AAB) and lactic acid bacteria (LAB), which convert coffee cherry mucilage sugars into acids (acetic or lactic acids). Their potential as starter cultures is being investigated for their benefits in controlling the fermentation process. The present study aims to characterize the indigenous AAB and LAB from wet fermentation of selected Arabica cherries from Itogon, Benguet. The isolates will be utilized as starter cultures that will allow for faster, time-controlled and efficient coffee fermentation process, delivering high yields of green coffee beans of consistent and high quality. A total of 12 isolates were characterized for their potential as starter cultures by analyzing the acid production from glucose, tolerance to alcohol (4, 6, 8, and 10% ethanol), salt (1%, 3%, 5%, and 7%), varied pH levels (4, 5, 6), and acetic acid production. Eight (8) isolates were preliminary identified as gram-positive and four (4) were gram-negative, which demonstrated negative and positive catalase reaction, respectively. Of these, 11 isolates showed acid production from glucose with their solubilization indices, ranging from 2.22 mm to 3.73 mm. Moreover, all putative AAB and LAB isolates were able to grow at 4% and 6% ethanol, except isolate ATIC.3 which was confirmed to be non-tolerant at the latter concentration. Consequently, isolates MB6A.3, ATIB.4.1, AB5A.2, AB5A.4, and ABIB.4 were tolerant at 8% ethanol, while both AB5A.2 and AB5A.4 isolates proliferated at 10% ethanol. For acetic acid production, isolates were cultured in ethanol-yeast extract medium supplemented with 2% (v/v) ethanol. Isolates AB5A.2, ABIB.5, AB5A.4, and ATIC.3 displayed the highest acetic acid production of 0.34%, 0.36%, 0.37%, and 0.57%, respectively. In addition, it was also found out that all isolates were able to proliferate in an acidic environment. The 16S rRNA gene analysis revealed that these isolates belonged to the genera *Gluconobacter*, *Leuconostoc*, and *Weissella.* The starter culture technology developed by the study will be beneficial for coffee farmers, traders, and industries, aiming to improve and produce specialty coffee in the Philippines.

Keywords: acetic acid bacteria, arabica coffee, fermentation, lactic acid bacteria, starter culture

BSD-26

STRESS TOLERANT PLANT GROWTH-PROMOTING RHIZOBACTERIA FROM THE COFFEE RHIZOSPHERE AS POTENTIAL BIOFERTILIZERS TO IMPROVE THE GROWTH AND YIELD OF COFFEE

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Coffee is one of the most heavily traded and widely consumed pharmacologically active beverages worldwide. At present, several farming system strategies are being adopted to increase the production of coffee beans, which include the application of synthetic fertilizers. However, the excessive use of chemical fertilization poses environmental and health threats due to leakage of unabsorbed substances, leading to soil acidification and water contamination. Biofertilizer consisting of plant growth-promoting rhizobacteria (PGPR), is an excellent alternative to reduce chemical fertilization and pesticide input to coffee plants without compromising the environment. This study aims to characterize and identify the PGPR obtained from the Liberica and Robusta coffee rhizosphere. Initially, phosphate solubilizing bacteria were screened using Pikovskaya's medium and all colonies with clear halo zone were selected. A total of 19 rhizobacterial isolates were recovered and purified by which 11 isolates are Gram-positive while 8 are Gram-negative. The phosphate solubilization indices of the isolates ranged from 2.1 mm to 3.5 mm and all of them produced indole acetic acid (IAA). Among these, hydrogen cyanide (HCN) production was observed in 1 isolate while the enzymatic activities like amylase, protease and pectinase were observed in 10 isolates. Meanwhile, certain bacterial species tolerated the 7% NaCl and the pH ranging from 4 to 11. Majority were tolerant to 1600 ppm of manganese and 800 ppm of lead and copper. This study observed the 6 promising PGPR of coffee in terms of phosphate solubilization, IAA production, HCN production, lytic enzyme activities and abiotic stress tolerance. PGPR can be utilized as an alternative to chemical fertilization to improve the growth of coffee plants in the Philippines, especially under stressed soil environment.

Keywords: biofertilizer, coffee rhizosphere, plant growth-promoting rhizobacteria

BSD-27

THE EFFECT OF CULTIVATION TIME ON CHITOSAN PRODUCTION
OF *Rhizopus oryzae*

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Fungi are promising alternative source of chitosan, a novel biopolymer with unique properties and numerous industrial, food, and biomedical applications that are typically derived from crustaceans' exoskeletons. As fungal sources showed promising substitute for chitosan production for commercialization, the need to optimize fungal cultivation, production and chitosan extraction methods are of great importance. In this study, the effect of cultivation time in relation to chitosan production as well as the determination of the Degree of Deacetylation (DDA) and characteristics of each chitosan yield using Fourier Transform Infrared Spectroscopy (FT-IR) were observed and analyzed. The fungal mycelia were cultivated at 72h, 96h, 120h, 144h, and 168h in triplicates using a modified medium adapted from the study of Vaingankar and Juvekar (2014) and were deproteinized, deacetylated, and purified to extract the chitosan. The results revealed that the highest average yield of fungal chitosan was 17.46% (95 mg chitosan) with 71.16% DDA cultivated for 96 hours, in comparison with 12.67%, 10.74%, 12.31%, and 12.61%, cultivated for 72 hours, 120 hours, 144 hours, and 168 hours respectively. Resulting trend showed that the cultivation time of *R. oryzae* influenced the chitosan yield, DDA and the characteristics of the produced chitosan, where the highest amount of extractable chitosan is at its late exponential phase.

Keywords: *Rhizopus oryzae*, biopolymer, chitosan, deproteinized, deacetylated

ASSEMBLAGES AND MICROHABITATS OF ANURAN FAUNA OF MOUNT MARAGANG, MOUNT TIMOLAN PROTECTED LANDSCAPE, ZAMBOANGA DEL SUR

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Philippines is a home to a spectacular and diverse assemblage of amphibian fauna and is significantly recognized as one of the world's most important herpetofauna center in terms of endemism. Amphibians represent the most ecologically sensitive fauna group and scientifically reported as excellent indicators of global environmental health and contamination. Nearly 50% of amphibians in the country are currently at high risk of extinction. The Mount Maragang of Mount Timolan Protected Landscape is promoted as tourist destination the province. However, to-date, only limited scientific research is available in the protected area. More so, its anuran assemblage has not been documented. Thus, this funded research was carried out to generate information on the anuran assemblages of Mount Maragang, more so, the microhabitat, species richness, diversity, conservation and endemism of anurans was also presented. Survey of anuran species was done last 2021-2022 using standardized method, microhabitat was classified as three category: ground, arboreal and aquatic. A total of 16 species from 7 Families of anurans was documented, with Dicroglossidae as the most specious family (6 *spp.*). In accounting the conservation status of anuran species of Mount Maragang, four Near Threatened species was recorded: *Limnonectes diuatus*, *L. macrocephalus*, *L. magnus*, *Megophrys stejnegeri* while *Ansonia muelleri* is classified as vulnerable species. In terms of endemism, 7 species are Philippine endemic, 4 Mindanao endemic and 1 Luzon endemic. Two Invasive Alien Species was also documented: *Rhinella marina* and *Hoplobatrachus rugulosus*. Significantly, the results revealed high diversity value (2.49) and evenness (0.90) of anurans in the area. Majority of the anuran species are encountered in aquatic habitat (*Ansonia muelleri*, *Hoplobatrachus rugulosus*, *Fejervarya vittigera*, *Limnonectes leytensis*, *L. diuatus*, *L. magnus*, *Kalophrynus sinensis*, *Pulchrana grandocula* and *Staurois natator*), whereas, only *Polypedates leucomystax* is arboreal. The presence of microhabitat influenced the assemblage of anuran fauna in an area for their survival and breeding sites. In this study, *Ansonia muelleri* and *Kalophrynus sinensis* exhibited overlapping of microhabitat commonly encountered in ground and aquatic habitat. This could suggest that both species uses the ground microhabitat as a refuge at daytime and moves toward the aquatic habitat during nighttime, possibly for foraging and breeding. Generally, the anuran assemblage of Mount Maragang were observed to be strictly aquatic suggesting that these species could be more sensitive to habitat alteration and human-induced activities as they may not be able to use other microhabitats. Thus, this strongly suggest that conserving and maintaining the pristine ecosystem of Mount Maragang is vital for the survival and protection of anuran faun in the area.

Keywords: Mindanao PAIC, endemism, aggregate, invasive alien species

BSD-29

DIET COMPOSITION OF INVASIVE CANE TOAD (*Rhinella marina,* Linnaeus 1758) COLLECTED FROM MUNICIPALITIES OF RAMON MAGSAYSAY AND AURORA, ZAMBOANGA DEL SUR

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Philippines harbours high diversity and endemism in terms of amphibian assemblage, however, an approximate of 45% of the country's amphibian fauna are threatened with extinction due to habitat loss, deforestation, climate change and presence of Invasive Alien Species. In the country, two species are known as harmful invasive species due to their direct predation and competitive behavior to other species, the Chinese bullfrog (*Hoplobatrachus rugulosus*), and cane toad (*Rhinella marina*). With the continuing rapid growth of urbanization in the country, shared with the global decline of amphibian population, determining the ecology including the dietary composition of amphibian fauna is vital to take a deeper knowledge on the life history and the possible impacts of habitat modifications to amphibian fauna in a highly urbanized environment. Unfortunately, there are only limited studies related to dietary composition of cane toad in the Philippines especially in Mindanao. Thus, this pioneering study on the feeding preferences of the invasive cane toad (*R. marina*) in different habitat within the municipalities of Ramon Magsaysay and Aurora, Zamboanga del Sur was carried out last 2021 between two seasons (wet and dry). A total of 180 invasive cane toad live samples was collected in three sampling stations: a) grassland; b) forested area; and c) near human settlements. All collected live samples were subjected to gut analysis and collected food items were classified as animal prey, plant matter or others. Based on the results, the gut content of *R. marina* greatly composed of arthropods. The collected samples of cane toad in the municipality of Ramon Magsaysay showed to have the most diverse food groups varies from the most commonly occurring species of ants (FOO=80%), millipedes (FOO=80%), and beetles (FOO=75%), while the less common diet are spiders (FOO=15%), butterfly and moths (FOO=5%) and grasshoppers, locusts, crickets (FOO=5%). On the other hand, *R. marina* in the municipality of Aurora, had only four food group preference which include mostly of smaller food diets such as ants (FOO=90%), millipedes (FOO= 20%), mites (FOO=10%) and beetles (FOO=10%). Notably, skink tail from Order Squamata was found in the gut content of only one sample of *R. marina* in Ramon Magsaysay. By means of plant material of *R. marina* diet, high composition of twigs was observed in Ramon Magsaysay, whereas, *R. marina* in Aurora preferred fruits. In terms of other material diet of *R. marina*, samples from Ramon Magsaysay preferred pebbles and plastic, whereas, samples from Aurora preferred pebbles. Generally, the results suggest that the occurrence of invasive cane toad in terms of prey availability, signify as one of possibly many underlying threats in the sampling sites which may affect its biological diversity.

Keywords: gut analysis, prey, introduced, Mindanao

BSD-30

DISTRIBUTION AND DIVERSITY OF FRESHWATER FISH FAUNA IN MOUNT TIMOLAN PROTECTED LANDSCAPE (MTPL) LAKE AND RIVER SYSTEM

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Freshwater ecosystem to-date face challenges worldwide and there has been no comprehensive global analysis of freshwater biodiversity available compare to terrestrial ecosystems. Over decades, freshwater biodiversity has declined more rapidly and the conservation efforts still continue to lag far behind that of terrestrial and marine systems. The freshwater fish are among the most endangered taxa because of their vulnerability to aquatic habitat modification. The proclamation of Protected Areas in the country is one of the major strategies adapted to regulate the drastic high rate of biodiversity loss. One of the identified Protected Area (PA) in Philippines, and one of the only two presently declared PA in the province of Zamboanga del Sur is the Mount Timolan Protected Landscape (MTPL). The MTPL is the headwaters of two major river systems in the province- the Dinas River and Labangan River. A pioneering ichthyofaunal survey was done in Mount Timolan Protected Landscape last 2021-2022 to determine the distribution, biological diversity, dominance and species composition of freshwater fish fauna in Lake Maragang, Maragang River, Datagan River, Sagpang Creek and Kalawisan Creek of MTPL. The survey collected 3755 individuals comprising 13 species from 9 Families. Assessment of species composition reveals 9 native, 3 Introduced and 1 Invasive Alien Species. Shannon-Diversity Index value ranges from 1.06-2.09 with Maragang River being the most diverse among sites (species=12; H'=2.09) and Kalawisan Creek (species=3; H'=1.06) as the least. In contrary, low Simpson's Dominance Index values were observed ranges from 0.65-0.85. In terms of species Evenness, all sites recorded high value varies from 0.81-0.97 which signify that all species have similar distribution among sites. Meanwhile, diversity t-test value showed significant difference among sites ($P<0.05$). The impact of anthropogenic disturbances based on Shannon-Weiner values was interpreted and revealed that Lake Maragang, Datagan River, Sagpang Creek and Kalawisan Creek are considered to be severely impacted while Maragang River is moderately impacted. During the course of the survey, Lake Maragang have been subjected for recreational used such as swimming and *kayaking* activities. Also, presence of introduced and Invasive Alien Species in the lake was noted to have predated which could potentially displaced the population of native species in the area. Overall, the distribution of ichthyofauna in Mount Timolan Protected Landscape shows that the habitat spaces among sites is equally distributed both for dominant and non-dominant species. Generally, this study is the first ichthyofauna research which successfully generated a checklist and distribution of freshwater fish fauna and significantly provided baseline information for future research and sustainable conservation strategy in the Mount Timolan Protected Landscape.

Keywords: limnology, Zamboanga peninsula, lake, evenness, introduced species

BSD-31

DISTRIBUTION OF REPTILIAN FAUNA ALONG ELEVATION GRADIENTS IN ANDANAN WATERSHED FOREST RESERVE, PHILIPPINES

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This study assessed the spatial distribution of reptilian fauna in Andanan Watershed Forest Reserve (AWFR), Philippines. The reptilian fauna was surveyed in the four sampling stations with elevations ranging from 100-770 masl using intensive visual encounters or opportunistic methods. A total of 216 individuals belonging to 27 species of which 18 significant records of Philippine and Mindanao endemics were accounted in the area. Jacknife 1 and Chao 2 estimators suggest that 35 to 43 species may be added with increased sampling. Four species of lizards (*H. frenatus, E. multicarinata, E. multifasciata*, and *L. smaragdina philippinica*) were distributed throughout the four sampling stations. The species richness of reptiles exhibited linear and monotonic decline with increasing elevation (r^2=0.11, p=0.04). While the same trend was observed for non-endemic species (r^2=0.11, p=0.005) however, a different trend was observed for Philippine endemic species wherein more endemic species were observed as elevation increased (r^2=0.16, p=0.001). This pattern might be attributed to the different abiotic factors including temperature, forest cover, and relative humidity among others. Monitoring, as well as protection and conservation of the forests of the AWFR, are essential to safeguard the reptiles and other biodiversity of the watershed as anthropogenic activities were observed not just in lowland forests but also in higher elevations of the forest reserve.

Keywords*:* conservation, diversity, monotonic decline, Philippine endemic

DISTRIBUTION PATTERN OF CAVE-DWELLING SPIDERS IN CULAPNIT CAVE, CARAMOAN

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Caramoan Island is a rugged and remote landscape of the karst ecosystem that is home to various caves within the region. Among arthropods, spider species are the most dominant and diverse. With their ecological importance, spiders are essential bio-indicators for examining how human disturbances affect the natural ecosystem. However, studies on cave-dwelling spiders in Caramoan remain poorly explored. This study was conducted to determine the diversity and distribution pattern of cave-dwelling spiders in Culapnit Cave, Caramoan, Camarines Sur. Sampling was done through a combined method: sweep netting, hand collection, aerial hand collection, catch and release and direct counting. Seventy-six individual species belonging to one order and five families were identified within the five established sites in Culapnit Cave. These include thirty-four (34) individual species of *Psechrus wade* (psechrid spider), five (5) individual species of *Cyclosa dives* (trash line orb weaver), two (2) individual species of *Omoedus sp.* (jumping spider), twenty-one (21) individual species of *Heteropoda tetrica* (huntsman), and fourteen (14) individual species of *Orphnaecus pellitus* (tarantula). Abiotic factors such as temperature, relative humidity, and light penetration directly affect the distribution pattern of cave-dwelling spider species. *Omoedus sp.* and *Cyclosa dives* are observed only in the cave entrance. *Psechrus wade* was present in the Twilight Zone. *Heteropoda tetrica* were commonly found in all sites, while *Orphnaecus pellitus* thrive only in the deep zone. Culapnit Cave has a relatively moderate species diversity index with more or less even distribution. Wall surface was the most common microhabitat of cave-dwelling spiders. Anthropogenic activities and frequent visitation of residents and tourists may directly affect spider diversity inside the cave.

keywords: culapnit cave, ecological zones, distribution pattern, cave-dwelling spider, microhabitat

NEW DISTRIBUTION RECORDS OF AMPHIBIANS AND REPTILES IN TINUY-AN FALLS PROTECTED LANDSCAPE, SOUTHEASTERN MINDANAO, PHILIPPINES

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The Tinuy-an Falls Protected Landscape (TFPL), located south of the Diwata Range is a protected area (PA) established in the Caraga Region via the Expanded National Integrated Protected Areas System (ENIPAS) Act of 2018. In contrast to the well documented herpetological diversity of its neighboring northeast Caraga, what we know about herpetofauna of southern Caraga are based on historical records sporadically distributed in different localities of Surigao del Sur. We conducted surveys for herpetofauna in low-elevation (100–200-m above sea level) forests of Tinuy-an Falls Protected Landscape during the wet season (Jun 10–12 and Sep 1–5, 2022). Scan searches for amphibians and reptiles were done during diurnal (0900–1100 h) and nocturnal walks (1900–2200 h) along a two-km line transect established in advance secondary forests of TFPL. We recorded specimens' natural history data (e.g., mass, snout to vent length, microhabitat) and utilized standard preparation techniques for voucher specimens). Here, we highlight the augmented knowledge of Surigao del Sur's herpetofaunal diversity and present 20 new distribution records of amphibians and reptiles (*Pelophryne brevipes*, *Platymantis corrugatus*, *P. dorsalis*, *Limnonectes leytensis*, *Limnonectes magnus, Kalophrynus sinensis*, *Megophrys stejnegeri*, *Pulchrana grandocula*, *Sanguirana mearnsi, and Philautus leitensis, Brachymeles orientalis*, *Parvoscincus steerei*, *Tropidophorus misaminius, Otosaurus cumingi, Boiga dendrophila latifasciata, Psammodynastes pulverulentus*, *Rhabdophis lineatus*, *Aplopeltura boa, Naja samarensis,* and *Tropidolaemus subannulatus)* from Tinuy-an Falls Protected Landscape, Bislig, Surigao del Sur, southeastern Mindanao. We suggest a more exhaustive biotic inventory to document herpetological diversity in the area; augmented knowledge about species presence and richness using distribution records, supplement our current understanding about the biodiversity of Caraga Region.

keywords: biodiversity, herpetofauna, Mindanao faunal region, protected area, species occurrence

BSD-34

PARASITOLOGICAL SURVEY OF THE INVASIVE ANURAN SPECIES IN SELECTED BARANGAYS OF BUTUAN CITY, AGUSAN DEL NORTE, PHILIPPINES

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Invasive species dominate anuran diversity in urbanized areas in the Philippines, which may have been linked to anthropogenic activities, infectious diseases, and parasitic infection brought on by the widespread invasive species. This study was conducted to determine the parasites of invasive anuran species found in selected barangays in Butuan City. Of the 91 collected individuals of invasive anuran species, *Rhinella marina* (88%) yielded the most abundant species, followed by *Hoplobatrachus rugulosus* (12%) and *Kaloula pulchra* (3%). Five species of parasites were recovered and identified. Among the identified species of parasites, *Spirometra mansoni* was the most prevalent (17.58%), followed by *Echinostoma* sp. (16.5%), *Rhabdias bufonis* (14.3%), *Cosmocerca* sp. (6.6%), and *Strongyloides stercoralis* (3.30%), respectively. In terms of mean intensity, *Spirometra mansoni* (7.67) has the highest mean intensity, followed by *Cosmocerca* sp. (5), *Strongyloides stercoralis* (3.33), *Rhabdias bufonis* (3.30), and *Echinostoma* sp. (2.73). The parasitological survey showed that *H. rugulosus* has the highest prevalence and infection of parasites. Also, the residential area has the highest parasite prevalence among the habitat types, and larger hosts harbor high prevalence and infection intensity. The male and adult host has a higher prevalence. Generally, the results indicate a high risk of parasite transmission from anurans to other animals. These data will give insights to the community to lessen the population of invasive anuran species for the safety of native anurans and the locals.

Keywords: invasive anurans, habitat types, endoparasites, prevalence, mean intensity

TERRESTRIAL FAUNA AND PHYSICOCHEMISTRY OF DATS AND ASBANG FAK SOL CAVES, MATANAO, DAVAO DEL SUR

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Dats and Asbang Fak Sol caves that are located in agricultural area of Sitio Talambato, Barangay Asbang, Matano, Davao del Sur are prospect for ecotourism. Policies and management plan for this endeavor must be anchored in scientific research such as biodiversity and ecological assessments to be more systematic and effective. Therefore, assessment on terrestrial fauna and physicochemical status of cave were performed that focused on determination of microclimate, physical and chemical conditions of soil and water; identification of the bats, herpetofauna and macroinvertebrates, and their diversity and conservation status. The sampling was done in July and November, 2021. Cave zones namely, entrance zone, twilight zone, transition zone and dark zones were considered as subsites for data collection. Microclimate parameters such as air temperature ranged only from 23-24.3 °C for Dats Cave (DC) and 24.5-25.5 °C in Asbang Fak Sol Cave (AFSC) while relative humidity in both caves ranged high with 93.5%-98% in Dats Cave and 91%-98% in AFSC. The two caves demonstrated moderate (1 mL/30 sec) to high drip rate (<2mL/30 sec.). The sediments in the two caves are homogeneous sandy-loam and the pH in DC was slightly alkaline while in AFSC varied in each zone with moderately neutral to slightly acidic, and the organic carbon varied from low to high. The coliform level in water reached 24,000 MPN. The nitrate in DC reached 2mg/L while the phosphate was relatively higher in AFSC. Vertebrates in the caves consist of three insectivorous bat species and six species of anurans. *Rhinolophus arcuatus* was only observed in DC while *Hipposideros diadema* and *Miniopterus tristis* were roosting in AFSC. Endemic frogs such as *Pulchrana grandocula* and *Limnonectes magnus* were observed but some none native and invasive frogs were also sampled. Also, it is noteworthy to emphasize the absence of reptiles in both caves. The most common invertebrate groups are arachnids and insects. *Charon* sp., cave crickets and crabs were commonly encountered in the two caves. Vertebrate diversity in both caves is low compared to moderate level diversity among macroinvertebrates. Most vertebrate IUCN status were least concerned except for *L. magnus* which is near threatened. However, due to limitation in resources, most macroinvertebrates were only identified to genus level, thus, impossible to identify their IUCN status. It is safe to assume that the condition of both biological and environmental in DC and AFSC are influenced by the agricultural activities in the epigenean environment. Thus, restoration of the surrounding vegetation of caves is recommended to minimize the effect of future disturbance and could possibly promote recruitment of wildlife.

Keywords: cave fauna, environmental variables, bats, macroinvertebrates, anurans

ENGINEERING SCIENCES AND TECHNOLOGY

EST-01

ACTIVATED CARBON FROM SUGAR PALM (*Arenga pinnata*) WASTE PRODUCT

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Activated carbons have many known applications like air purification, decaffeination, gold purification, metal extraction, water purification, medicine, sewage treatment, air filters in gas masks and respirators, and filters in compressed air. Sugar palm also known as *kaong* is one of the most useful palm species because varieties of products can be acquired from almost all parts of the tree, specifically palm sap being the most important product. Sugar palm waste products like husk and fiber can still be useful and can be converted into high-value product if it is processed as activated carbon. Sugar palm husk and fiber with carbonization of 45 minutes have a relatively higher surface area ranging from 2000 to 3000 m^2/g compared to the commercially available activated carbon with 900-2000 m^2/g. Test results also show that activated carbons have 0% moisture, which means they can effectively use as an air filter and the absence of oil in water means they can be an effective material for water filters. Since there are many known uses of activated carbon, it is recommended to explore its uses to develop new products that can be distributed in the market.

Keywords: activated carbon, surface area, kaong fiber, kaong husk, filter

EST-02

ANDROID-BASED AUGMENTED REALITY (AR) APPLICATION: A LEARNING RESOURCE FOR DEVELOPING THE STUDENT'S SPATIAL ABILITIES IN TECHNICAL DRAWING COURSE IN THE POST-COVID-19 PANDEMIC

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Analyzing and translating two-dimensional (2D) orthographic drawing into three-dimensional (3D) shapes (and vice versa) in Technical Drawing (TD) is an important learning competency under blueprint reading in developing the spatial abilities of students. Nevertheless, the idea of constructing three-dimensional objects mentally and visually is still seen as a tough topic for students to comprehend. The difficulty was heightened during and after the Covid-19 pandemic since schools resorted to flexible learning systems (FLS) which included limited face-to-face classes and modular instruction. Hence, in CTU-Tuburan Campus, Tuburan, Cebu, an alternative teaching-learning resource was introduced which facilitated the instruction of blueprint reading subject matter of the Technical Drawing course. To elucidate the queries in mind, an instructional intervention was implemented using a custom-built augmented reality (AR) mobile application which is offline as an alternative learning medium that could assist students, specifically, in understanding the concepts of two-dimensional plane drawing and three-dimensional forms. The effectiveness of the instructional intervention was verified through a quasi-experimental study. The one-group pretest-posttest quasi-experimental design was used wherein no random selection of the respondents; all available students were considered subjects of the study. Before the intervention, the students were given a pretest to determine their initial knowledge. The students were given demonstrations on how to install the application on a mobile device and how to use it with printed materials to get the most out of the offline learning resource when studying collaboratively or independently during off-campus asynchronous learning. After one grading period of using mobile AR application, a posttest was administered to see if there is an effect on students learning. Based on the normalized gain (n-gain) score of 0.61, the integration of custom-built AR mobile applications as learning resources is reasonably effective in developing and improving students' spatial ability. Furthermore, the results of the t-test rejected the null hypothesis of no significant difference between the performances of the students in the pretest and posttest exams. Now, it is sensible to claim that the group of students improved their performance after including the android-based AR mobile applications in their spatial learning exercises, which is a crucial skill in the blueprint reading of the Technical Drawing course.

Keywords: augmented reality (AR), spatial skills, mobile learning resources, 2D & 3D drawing, post-Covid-19 instruction

DESIGN AND DEVELOPMENT OF A SMALL-SCALE PROTOTYPE FOR TREATING SWINE WASTEWATER USING BIOREMEDIATION AND TRICKLING FILTRATION PROCESS

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Swine farms usually dump effluents to open spaces, rice fields and to bodies of water such as lakes, creeks and rivers. Effluent disposal that involves the use of water to flush swine wastes out of the pens, permitting to flow to the nearest creek or river is expected to worsen soil, air and water pollution through its tributaries. A prototype of a small-scale swine wastewater treatment system was installed and tested for its effectiveness. The design and development of this prototype was done so that the SWW effluent from piggery farms could conform to the Class C effluent standards for animal production sector issued by the DENR in DAO No. 2016-08 Section 7, which states that discharges from any point source shall at all times meet the effluent standards set forth to maintain the required water quality per water body classification. The researchers considered the significant effluent quality parameters for animal production industry set in DAO No. 2016-08. These parameters, which includes BOD, Phosphate, Ammonia, TSS and Total Coliform were considered in designing and fabricating the wastewater treatment system. Similarly, previous studies on SWW treatment about the utilization of LABS, *Moringa* oleifera extract, and alum were studied carefully, then combined and adapted by the researchers for the development of the prototype. Residence time in trickling filter and the overall design components such as the materials of construction were also studied for optimum operation. The treatment unit was evaluated in terms of the properties of the SWW before, after primary treatment and after over-all treatment. The results of data were collected and were statistically tested using two-sample t-test. All of the significant parameters, except ammonia, conformed to that of the General Effluent Standards by DENR for Class C waters. Thus, the treated effluent can be discharge to fishery water and other aquatic resources; recreational Water Class II; or agriculture, irrigation, and livestock watering after further ammonia removal.

Keywords: bioremediation, LABS, Moringa extract, swine wastewater, trickling filtration process

EST-04

DESIGN AND DEVELOPMENT OF SENSOR ARRAY FOR CHILDREN SCREEN EXPOSURE DETECTION AND CLASSIFICATION BETWEEN STATIC AND DYNAMIC MEDIA

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With the digital age's progression and the COVID-19 pandemic, people's screen time has increased, especially among children, which can cause physical, behavioral, and cognitive consequences. As the World Health Organization suggested, there should be no screen time (ST) for children between ages 18-24 months, 1 hour for ages 3-5, and 2 hours for ages six and up. The type of screen exposure should also be considered as it is another factor in child development. Researchers developed solutions for measuring screen time in which the sensor-based approach accurately detected digital screen time. However, none of the previous studies focused on media classification as the first step in categorizing screen content, whether static or dynamic.

The researchers developed multiple sensor array setups to collect data at distances 20, 30, 40, and 50 cm between the sensors and the digital device to categorize media as static or dynamic and screen or no screen exposure. Each sensor combination measured the RGBW values of the laptop, tablet, and smartphone screens showing similar still images and videos. The preprocessed raw data were used to generate fifty additional features, such as the ratio between the current and prior sensor readings and the virtual light channels (VLC). Machine learning (ML) models Support Vector Machine, Random Forest (RF), and Naive Bayes were compared and used to determine which model will be optimized, whichever yields the highest K-Fold accuracy.

All the K-fold average accuracies across multiple distances and screen sizes are above 96%, indicating that the system is feasible in classifying at various parameters. Furthermore, the highest K-fold accuracy and F1-score were obtained using the TCS3200 color sensor and GL5528 photoresistor employing the RF ML model, which yielded a K-fold average accuracy of 99.87% and F1-scores of 1.00 on the three exposure types. The best distances for classification are 30 cm to 40 cm, while classification at 50 cm yields inconsistent results compared to the other distances. After feature and parameter optimization, the K-Fold accuracy yielded the same accuracy.

By employing the TCS3200 and GL5528 sensors, the highest accuracy was achieved using RF ML and when separate sensors were used to measure RGB and W values. This accuracy is achieved with an optimal distance of 30-40 cm, as a distance starting at 50 cm can lead to lower accuracy. The valuable features, such as the chosen VLCs and sensor value ratios, can open up more research opportunities in studying its relation to ST health consequences. This study helps to further the development of a sensor-based approach to detect digital screens, monitor ST, and classify the content to mitigate the harmful effects of ST and exposure on children's development.

Keywords: screen time, digital screen detection, static and dynamic media, light and color sensors

EST-05

DEVELOPMENT OF AN EARTHQUAKE SHAKE TABLE FOR THE EXCITATION ANALYSIS AND PERFORMANCE EVALUATION OF STRUCTURAL MODELS

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The study focuses on the development of an earthquake shake table for data and performance monitoring of a pre-designed structural base isolation system that will pave way to the structure's improvement of design through simulation of damping motion of the structural model in response to different earthquake magnitudes. The earthquake shake table gathers information on its test subjects by the use of attached structural seismometer sensors to calculate its damping motion and base shears, which are directly inputted to built-in monitoring software. The test subjects used for the experimentation process of the earthquake simulation table are two high-rise structure models, which were demonstrated with towers constructed with different materials evaluated through Buckingham pi theorem to replicate the most accurate results of an actual structure's excitation during an earthquake. The two test subjects differ in their structural foundation, one is structurally base-isolated and the other is conventionally base-attached. The integration to the study of the DPWH guidelines and implementing rules of earthquake recording instrumentation for buildings were the basis of the location of seismometers to the test models to ensure that standard earthquake recording methods are verified and accurately followed. The results of the working Titan Mk.III prototype features the excitation recordings of the test subjects via the system's accelerometers attached to the two structural test subjects combined with the magnitude produced by the earthquake shake table. The result of the test differs in the performance of the two test subjects wherein the base isolated-structure performed an average of 38.18% decrease in structural excitation compared to the other. To further improve the accuracy of the structural readings of the prototype, a 3D-rendered monitoring program is proposed to be integrated to Titans' data recording software to produce more aesthetically and user-friendly results. In conclusion, the raw data and results produced by the third generation prototype of the earthquake shake table provides the comparative analysis of the two structures wherein it produces the actual excitation basis of the structural models that underwent certain ground motion simulations through the Titan earthquake shake table.

Keywords: earthquake shake table, base-isolated foundation system, earthquake technology, earthquake engineering, structural engineering

EST-06

DEVELOPMENT OF CARWASH WASTEWATER TREATMENT SYSTEM USING POWDERED AND ACTIVATED *Moringa oleifera* (MALUNGGAY) SEEDS

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Water is a significant resource. Use in various ways, its conservation is important. Everyday activities, to include washing cars now present problems considering the impact to the environment and natural resources. Car wash used water for cleaning called wastewater consists of high suspended solids from brake linings, with sand and dust being washed away and traces amounts of surfactant from detergents used in car washing which are hardly degraded in the environment. This study aimed to investigate the potential of powdered and activated *Moringa oleifera* (Malunggay) seeds for carwash wastewater treatment system in different concentrations for parameters Surfactants and Total Suspended Solids. This study also aimed to determine the most efficient coagulant concentration in various concentrations (50mg/l, 150mg/l and 250mg/l) with the goal of setting compliance with Class B standards of DENR Administrative Order 2016-08 or the Water Quality Guidelines and General Effluent Standards. Five (5) liters of carwash wastewater was collected and transferred into the developed treatment system made from individual 18-L High-density polyethylene (HDPE) tanks for floatation, coagulation, adsorption, and sedimentation processes. The generated bubbles by the 220V, 3.5W and 0.15Mpa air pump aerator in the flotation tank allowed the surfactant molecules to attach its hydrophobic ends to the bubbles. Coagulation process followed which removed the contaminants such as suspended solids using 1740 revolution per minute mixing speed. Sedimentation process allowed the suspended flocs formed from the coagulation to settle. Adsorption process then took place with the activated *Moringa oleifera* seeds as the adsorbent. Final step is another sedimentation process where the suspended films formed from adsorption are allowed to settle out. 250 mg/L coagulant concentration was found optimum in removing surfactants with a removal efficiency of 65.62% while 150 mg/L coagulant concentration yielded the best removal efficiency for total suspended solids with the value of 99.27%. The researchers were able to develop a system for treating carwash wastewater using powdered and activated *Moringa oleifera* (Malunggay) seeds. The values of Total Suspended Solids for the three coagulant concentrations passed the Class B standards of DAO 2016-08. However, higher concentration of the adsorbent is recommended with longer sedimentation time for the surfactant parameter after failing to comply with the standards.

Keywords: *Moringa oleifera,* wastewater treatment system, carwash, coagulant, malunggay seeds

EST-07

DEVELOPMENT OF TERRA SIGILLATA SLIP UTILIZING ILOCOS KAOLINITIC CLAY AND RICE HULL ASH-DERIVED DEFLOCCULANT AS THIN COATING FOR LOCALLY FORMULATED DECORATIVE CERAMICS

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Terra sigillata slip (TSS) is generally prepared from a well deflocculated fine clays and was used to coat bone-dried clay wares instead of glaze during the ancient times. Ilocos Norte is known to be rich with several mineral resources for ceramic production wherein cooking pots coated with thick clays and uncoated flowering pots were the most common produced items. Herein this research, TSS were developed utilizing Ilocos kaolinitic clay (KC) and rice hull ash-derived deflocculant (RHA-DD) and evaluated as thin coating for locally formulated decorative ceramics substrates. Very fine KC particles were obtained by sedimentation method. TSS was prepared by mixing 300 grams of very fine KC, 7.5 grams of RHA-DD, and 630 grams of distilled water. Above mixture was shaken for about 20 times then let it settled for 1.5 hours (TSS-1.5H) and 48 hours (TSS-48H). TSS was obtained by siphoning the top 1/3 of the settled particles and properties such as specific gravity (1.17, 1.19) and viscosity (3 mPa.S, 5 mPa.S) were controlled and measured. Developed TSS were applied by brushing to formulated decorative ceramics substrates in 3-5 coats then polished with soft sponge (SPP) and hard object (HOP). Finally, TSS coated substrates were fired at 923 ºC using an electric furnace. Visual and microscopic evaluation results on the fired TSS coated substrates revealed that the surface and appearance were greatly improved. Also, Munsell color chart revealed that the color of the substrates changed after TSS coating and polishing. Uncoated substrates revealed a yellowish red color while coated SPP substrates exhibited light red color and coated HOP substrates exhibited dark red color. In addition, TSS-1.5H coated substrates showed rough-like and numerous striations in SPP and HOP, respectively. On the other hand, TSS-48H coated substrates showed glossy sheen and lesser striations in SPP and HOP, respectively. Furthermore, the measured coating thickness in the substrates were as follows: 17.12–38.31 µm, 15.18–21.66 µm, 11.84-22.04 µm, and 18.61–23.65 µm for TSS-1.5H-SPP, TSS-48H-SPP, TSS-1.5H-HOP, and TSS-48H-HOP, respectively. Therefore, these characteristics exhibited by the developed TSS suggests its promising application as thin coating material to locally produced decorative ceramic items. Moreover, this material can be very economical and beneficial to local potters as it very simple to apply and it requires very small amount of slip in achieving a smooth and glossy surface appearance.

Keywords: clay, coating, deflocculant, rice hull ash, terra sigillata

EST-08

DIATOMACEOUS EARTH: CHARACTERIZATION USING THERMOGRAVIMETRIC INFRARED (TG-IR) EVOLVED GAS ANALYSIS AND ITS POTENTIAL APPLICATION IN THE CERAMIC EARTHENWARE BODY

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Diatomaceous earth (DE) is a naturally occurring material and possesses low density and high porosity. In this study, the DE was characterized using Thermogravimetric Infrared (TG-IR) evolved gas analysis to investigate the pyrolysis of volatile products during thermal degradation. The TG-IR was set in different run marks at 10, 50, 60, 70, and 120 minutes timepoints with a heating rate of 10ºC per minute up to 1000ºC. The two- and three-dimensional (2D) and (3D) plots of TG-IR spectra of the volatile products at different time intervals were established.

The spectra fitted well to the functional groups with characteristic band compositions, such as H_2O (3505-3650 cm^{-1}), CO_2 (2400-2300 cm^{-1}), and anhydride (1850-1600 cm^{-1}). The intensity of the peak of each volatile product first increased with the temperature rise to approximately 350°C and then decreased gradually until the temperature reached approximately 650°C. The volatile products are usually pore-forming agents during reaction and decomposition. As the temperature further increases, the intensity of each volatile product begins to increase for the second time. The release of NH_3 and H_2O gases corresponds to the endothermic decomposition of the sample during heat treatment. These gases also diluted other combustible gases that are present during heat treatment.

As such, the material has a high potential use as the primary component in the ceramic earthenware body.

Keywords: diatomaceous earth, TG-IR, Evolved gas, ceramic earthenware body

EST-09

DIFFUSIVITY OF MOISTURE IN *Blumea balsamifera* (SAMBONG) LEAVES

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In the Philippines, one of the most prevalent diseases among Filipinos is diabetes. Anti-diabetic drugs prepared through drying of medicinal plants such as sambong are considered for diabetes control and treatment. In this study, the drying behavior and moisture transport mechanism of *Blumea balsamifera* (sambong) are investigated. Thin layer drying kinetics modeling was also conducted to better characterize mathematically its drying process. The experimental runs were conducted for two trials at two different inlet air fan settings (30% and 50%), which approximately corresponded to (0.80 and 1.0 m/s) of air velocity, and three different inlet air temperatures (45°C, 50°C, 55°C), using the Armfield UOP8 MKII convective tray dryer, thus having a total of 6 conditions and 12 runs. Drying occurred only at the falling rate period in all conditions. Drying rate generally increased with temperature, but only up to a certain point, where beyond it the opposite trend occurred. Changes in the morphology during the drying process caused by shrinkage may have led to this behavior. Out of the 10 thin-layer drying kinetics models tested, both the Demir and Kaleemullah models were best-fit. The effective moisture diffusivity for sambong ranged from $2.96 \times 10^{-12} \pm 1.13 \times 10^{-12}$ to $7.03 \times 10^{-12} \pm 2.82 \times 10^{-12}$ m²/s, while the activation energy of moisture migration in sambong ranges from 49.3 to 75 kJ/mol. The effective moisture diffusivity increased with temperature, indicating easier moisture migration as temperature is increased. Temperature has a significant effect on both the drying rate and effective moisture diffusivity ($p<0.05$), while air velocity has no significant effect on both ($p>0.05$). The effective moisture diffusivity vs moisture content (dry basis) profile of sambong supports the lack of a constant rate period and may imply the presence of two falling rate periods. Thus, the rate of moisture diffusion is internally controlled and governed by liquid and vapor diffusion. Studying the moisture migration in sambong is important to better understand and characterize its drying process, which could lead to better processing and manufacture of its anti-diabetic drugs.

Keywords: Sambong, *Blumea balsamifera*, moisture diffusion, effective moisture diffusivity, falling rate period

DIFFUSIVITY OF MOISTURE IN *Costus igneus* (INSULIN PLANT) LEAVES

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Costus igneus (Insulin plant) is a medicinal plant that has been extensively investigated to contain bioactive molecules that are conducive for diabetes treatment. Its leaves are dried as a post-harvest process to preserve its active components as well as prevent spoilage. To improve final product quality, a better understanding of the drying process and its involved moisture transport mechanism for the insulin plant system is essential. Thus, the effective moisture diffusivity, a transport property that characterizes all possible mass transfer mechanisms during the drying process, must be calculated. Thin-layer drying of insulin plant leaves occurs in a computer-controlled convective tray dryer set at air temperatures of 45, 50, and 55 °C, and fan settings of 30% and 50%, corresponding to air velocities of approximately 0.8 m/s and 1.0 m/s, respectively. From the specified conditions, the calculated effective moisture diffusivity values of insulin plant leaves ranged from $8.29 \times 10^{-13} \pm 7.74 \times 10^{-13}$ to $2.79 \times 10^{-12} \pm 9.02 \times 10^{-13}$ m^2/s, which is within the expected range of 10^{-12} to 10^{-6} m^2/s. Effective moisture diffusivities generally increased in proportion to an increase in air temperature and air velocity. Statistical analyses also indicate that both air temperature and air velocity have a statistically significant effect on the effective moisture diffusivity values. The activation energy was calculated based on the temperature dependence of effective moisture diffusivities and was determined to be 73.9 kJ/mol for 50% fan setting, within the expected range of 12.32 to 82.93 kJ/mol. For 30% fan setting, the correlation between effective moisture diffusivity and temperature was nonlinear, thus the system was non-Arrhenius and the activation energy cannot be determined. From effective moisture diffusivity plotted as a function of moisture content, it was observed that liquid diffusion is the dominant moisture transport mechanism during the first drying stage, while at the latter drying stage, vapor diffusion dominates. As effective moisture diffusivity is dependent on the physical characteristics of the medicinal plant, the obtained results are specific only to the insulin plant system. Thus, for industrial-scale production of dried *Costus igneus* leaf products, the calculated effective moisture diffusivity is beneficial for drying process modeling and design.

Keywords: activation energy, *Costus igneus*, effective moisture diffusivity, insulin plant, moisture transport mechanism

EST-11

DIFFUSIVITY OF MOISTURE IN *Lagerstroemia speciosa* (BANABA) LEAVES

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Drying is a crucial post-harvest process of a medicinal plant for the preservation of its medicinal qualities. Although the drying process has been advantageous in the preservation of the active ingredients in medicinal plants, improper execution of the process could lead to undesirable changes in appearance, flavor, and a significant loss of active ingredients. With that, the calculation of the transport property effective moisture diffusivity is essential to understand the drying process and determine the possible moisture transport mechanism occurring during the drying of the medicinal plant. In this study, the effective moisture diffusivity of *Lagerstroemia speciosa* (Banaba) – a medicinal plant whose dried leaves are used for treating diabetes in the Philippines will be calculated. The present study used a computer-controlled tray dryer at air temperatures of 45, 50, and 55 °C and a fan setting of 30% (~0.8 m/s) and 50% (~1.0 m/s). The effective moisture diffusivity of the leaves ranged from $6.6710-12 \pm 3.85 \times 10-12$ to $2.0610-11 \pm 9.84 \times 10-12$ m2/s in which the values increased with temperature and fan setting. However, based on statistical analyses, only the drying air temperature significantly affects the effective moisture diffusivity in Banaba leaves. From the effective moisture diffusivity values, the activation energy was calculated to be 80.7 kJ/mol (30% fan setting) and 68.1 kJ/mol (50% fan setting). Based on the variation of effective moisture diffusivity values with moisture content, the dominant moisture transport mechanism at the early stages of the drying operation is liquid diffusion. As the drying operation progress, vapor diffusion is the main mechanism of moisture transport. The calculated effective moisture diffusivity values and activation energies for Banaba leaves are within the expected range of 10-12 to 10-6 m2/s and 12.32 to 82.93 kJ/mol, respectively. The effective moisture diffusivity of a material depends on its property and the conditions within it. Therefore, calculating the effective moisture diffusivity of *L. speciosa* leaves would be useful in the design and modeling of the drying operation of the considered system for industrial applications.

Keywords: banaba, *Lagerstroemia speciosa*, effective moisture diffusivity, activation energy, moisture transport mechanism

EST-12

EFFECT OF THERMAL MODIFICATION ON THE FINISHING CHARACTERISTICS OF BOLO BAMBOO

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Thermal modification (TM) of lignocellulosic materials (i.e., wood and bamboo) is the process of subjecting them to high temperatures from 160-240ºC. The objectives of TM are the improvement of dimensional stability and durability with accompanying darkened color change. In this study, the effect of TM on the finishing properties of the bolo [*Gigantochloa levis* (Blanco) Merr.] bamboo was investigated.

Bolo was thermally modified in steam at 175˚C and 200˚C for 30 minutes. After TM, bamboo samples were prepared for clearcoat finish application. Nitrocellulose lacquer (NC), polyurethane (PU), and water-based PU (PUW) were the clearcoats used to evaluate the finishing characteristics of bolo.

Results showed that TM lowers pH, gloss and degree of lightness (L*) but increases dry film thickness. On the other hand, the adhesion property and gouge hardness of solvent-based finishes such as NC and PU significantly improved with heat treatment at 175˚C. At 200˚C, the hardness of both topcoats further improved, along with the adhesion property and acid resistance of PUW. Scanning electron micrograph revealed an improved adhesion bond on NC and PU applied on thermally modified at 175˚C.

As conclusion, it can be considered beneficial to subject bamboo to TM at 175ºC for improved finishing properties of engineered bamboo products.

Keywords: thermal modification, finishing, nitrocellulose lacquer, polyurethane, water-based polyurethane

EST-13

EFFECTS OF ROASTING CONDITION ON THE PERFORMANCE OF THE MACHINE, PHYSICO-CHEMICAL PROPERTIES AND HEAT-INDUCED CONTAMINANTS IN ROASTED CACAO BEANS

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Roasting is the process where heat treatment was applied to produce the fundamental chemical and physical changes in the structure and composition of cacao beans. Chemical reactions such as Maillard reaction and Strecker degradation which convert precursors into chocolate flavor characteristics occur during roasting. The project aims to determine the effects of roasting conditions on the performance of the machine, physico-chemical properties and heat-induced contaminants in roasted cacao beans.

The roasting process's optimum operating condition was obtained using the incomplete three-level-factor factorial experiment described in the Box and Behnken Design. Independent variables are roasting temperature, roasting time and loading capacity. The dependent variables were output capacity, specific energy consumption, pH, color and moisture content of the dried fermented beans.

The beans roasted at lower temperature and residence time produced brown color while beans roasted at higher temperature and residence time produced black color. The roasting temperature and time increase, the moisture content decreases. Likewise, as the loading capacity increases, the moisture content decreases slightly. The computed output capacity from different roasting conditions varies from 6.47-43.02kg/hr. The roasting time is inversely proportional to the output capacity while the loading time is directly proportional. Moreover, the roasting temperature has a slight effect on the output capacity of the machine. The effect of roasting temperature, time and loading capacity on the L values of cacao roasted beans showed decreased and gradually increased. The roasted cacao beans pH ranges from 4.96-6.77. The computed specific energy consumption varies from 1.44-35.73MJ/kg.

The roasted cacao bean samples at 175°C, 20min residence time and 15kg loading capacity and 150°C, 40min residence time and 10kg loading capacity showed no detected peak attributed to acrylamide. However, roasted cacao bean samples at 200°C, 30min residence time and 5kg loading capacity detected a peak attributed to acrylamide. The color of the samples detected of acrylamide is black.

The optimum roasting conditions are 186°C, 26min residence time and 13kg drum loading capacity to achieve the pH value of 5, 30.58kg/hr output capacity, 2.33MJ/kg specific fuel consumption, L value of 29.12 and 2% MC. Likewise, the roasted cacao beans detected with acrylamide are from the high roasting temperature and residence time. The estimated investment cost for the cacao bean roaster is P60,000. From the assumption that an investor shall acquire the machine, investment analysis showed that the project is economically viable because the net present value is positive, higher interest rate and benefit-cost ratio of more than one.

Development of sensor attached to the bean roaster that will detect the acrylamide level of roasted beans and the establishment of village-type cacao processing using a cacao bean roaster are highly recommended.

Keywords: cacao roaster, optimization, response surface methodology, output capacity, physico-chemical properties

EST-14

ON THE USE OF GRAPHENE OXIDE-REINFORCED STARCH FROM RICE (Oryza sativa) BRAN FOR BIOPLASTIC PRODUCTION

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For decades, plastics have always been a major source of pollution in the environment. Since conventional plastics face many issues that contribute to environmental pollution, bioplastics become a research interest, especially in food packaging. In producing materials for packaging, the tensile properties that starch encompasses are ideal and another potential additive to bioplastics is graphene oxide (GO) which will enhance its tensile strength, its capacity to absorb water and greatly helps degradation of bioplastics. In this study, starch was extracted from rice bran with a yield of 5-8%. The starch produced was utilized to make bioplastic sheets, with addition of glycerol as plasticizer and graphene oxide (GO) as a nanofiller. Bioplastic sheets were made with three varying amounts of GO: 0%, 0.4%, and 0.8%. The produced sheets are subjected to different tests to determine which amount of GO greatly contributes to their mechanical and physical properties. Sheets underwent tests for their characterization: tensile strength test, water absorption, biodegradability in soil and water, wettability, resistance to acid and base, antimicrobial propery test, FESEM and TGA. Before being tested for TGA and FESEM, results from other tests were considered to determine which is the best bioplastic. Among the three ratios of GO to starch, the best ratio is the one with the 0.8% GO. It showed great advantages upon its incorporation in the bioplastic mixture. The more GO is added into the mixture, the better properties for the bioplastic. The amount of starch that can be extracted from rice bran varies depending on the type of rice bran and the process of milling it undergoes. Stirring time of the mixture and the level of heat temperature contributes to the bubble formation in the plastic. The material in which the mixture will be placed after mixing contributes to its appearance and how fast the mixture will dry.

Keywords: bioplastic film, graphene oxide, *Gracilaria verrucosa*, extraction of starch, soil-burial method

EST-15

OPTIMIZATION OF CONDITIONS FOR HYDROLYSATE PRODUCTION FROM CORN COBS SPECIFIC FOR HIGH XYLOSE SUGAR YIELD

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Agricultural wastes like corn cobs are good sources of xylan which can be hydrolyzed to xylose sugars for eventual production of the high-value product, xylitol. Utilization of corn cobs as raw material for xylose sugar production is an alternative to its current use as a feed and fertilizer component and fuel for furnace (Latif and Rajoka, 2001).

Using Response Surface methodology (RSM), the optimum conditions [e.g. temperature ($^{\circ}$C), solid-to-liquid ratio (g/mL), acid concentration (% v/v), reaction time (min)] for the high temperature-dilute acid hydrolysis of ground corn cobs (CC) were determined. For xylitol fermentation, hydrolysates with the maximum amount of xylose, minimum amount of glucose and the least amount of inhibitory side-products released are preferred since high amounts of glucose lead to biomass formation instead of xylose bioconversion to xylitol.

The production of lignocellulosic hydrolysate from corn cobs by dilute sulfuric acid hydrolysis was optimized. Factorial experiments showed that 1) acid concentration, 2) solid-to-liquid ratio, 3) temperature, and 4) reaction time were significant factors for acid hydrolysis. Based from numerical optimization, the optimum acid hydrolysis conditions were as follows: a) temperature of 130 $^{\circ}$C, b) acid concentration of 4.98 % w/w, c) solids loading of 0.10 g/mL, and d) reaction time of 40 min wherein maximum xylose concentration of 49.44 g/L were obtained. The results of this study can be used for further researches on bioreactor testing and downstream processing of xylose production. The technology presents an alternative use for corn cobs and provides farmers a potential source of income from corn cobs.

Keywords: corn cobs, xylose, hydrolysate, dilute acid-high temperature

EST-16

PERFORMANCE ANALYSIS OF SUPPORT VECTOR MACHINE MODELS IN RAINFALL FORECASTING

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Rainfall forecasting plays a vast role in organizations that deals with disaster preparedness and mitigation. It can provide necessary information for strategic, tactical and operational planning of activities that can eventually save lives and properties. Originally design for clustering purposes, this study aims to evaluate the performance of Support Vector Machine (SVM) models in forecasting rainfall in Iligan City. Historical rainfall data collected from the Automated Rain Gauges (ARGs) of the Philippine Department of Science and Technology - Advance Science and Technology Institute (DOST-ASTI) underwent data preparation through data correction and data representation. Partitioning of the dataset was then conducted for the appropriate training, testing and validation sets. SVM models designing was then conducted by identifying SVM kernel function that befit the dataset followed by the identification of the SVM parameters and the identification of lag variable values that will determine the relationship between past and current values of the dataset. In evaluating the performance of the SVM models, Mean Squared Error (MSE) was used to measure the margin between the forecasted values and actual values of the validation set. Results of the study found out that out of the four evaluated SVM kernels, the Radial Basis Function (RBF) kernel had the best performance for the dataset due to its nonlinearity. Results of the parameter search also found out that c=100; g=1; e=0.1; p=0.001 are the ideal SVM parameters and that out of the four lag variable configurations, a per-12-hour report with lags up to 672-timesteps (i-672) in the past is the ideal lag variable having a MSE of 3.64. Overall, the results of this study showed that SVM has the potential to be a viable rainfall forecasting model given the proper data preparation, model kernel function selection, model parameter value selection and lag variable selection. As a consequence of climate change, heavy rainfall results to both foreseen and unforeseen natural disasters. By conducting performance evaluation of SVM models as forecasting tool, this study hopes to offer possibilities in developing close to accurate rainfall forecast.

Keywords: support vector machines, performance analysis, rainfall forecasting

EST-17

SILVER NANOWIRE-PVB REFLECTIVE HEAT COATING FOR ENERGY SAVING BUILDING

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Air conditioning (AC) is essential, particularly in tropical countries like the Philippines, where temperatures can go beyond 40 ºC during the summer. The cooling system is typically one of the largest energy consumers for buildings. Consequently, there is a steady increase in electricity costs due to high fuel prices. Glass is one of the most popular and versatile building materials. However, it allows infrared light to pass through and transmit heat into a building. Blocking the infrared (IR) light would help regulate the temperature inside buildings more efficiently. This study developed a silver nanowire (AgNWs)-PVB (polyvinyl butyral) composite spray coating that could decrease the transmittance by at least 30% in the UV region and at least 25% at the NIR. Average transmittance at VIS is as much as 63.50% which highly depends on the concentration of PVB and AgNWs. More AgNWs decrease the transmittance at UV, VIS, and NIR regions.

Keywords: silver nanowire, spectrally selective, spray coating

THE EFFICACY OF ACTIVATED CARBON DERIVED FROM SPENT COFFEE GROUND OF KAPENG BARAKO (*Coffea liberica*) IN TREATING DOMESTIC GREYWATER

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When adequately treated, greywater represents a potent alternative water resource, as it constitutes a large proportion of household wastewater. This study aims to treat domestic greywater by the use of activated carbon derived from spent coffee grounds of kapeng barako (*Coffea liberica*). The spent coffee grounds of kapeng barako undergone sun drying, washing with distilled water, oven drying at 100°C for 24 hrs, chemical impregnation with 0.2MHCl, neutralization with distilled water, and carbonization at the muffle furnace at 500°C for 35 minutes in order to produce an activated carbon. The activated carbon produced by the mentioned method resulted a specific surface area of 523.202 m^2/g and a pore volume of 0.716cc/g which indicates a good adsorbent is produced and has good properties for treating domestic greywater. Moreover, the researchers use a columnar laboratory setup for treatment and vary the bed height of activated carbon by 3, 4, and 5 inches. Treated and untreated greywater was then tested for its physicochemical properties- Color, Odor, TDS, TSS, pH, BOD, COD, Oil and grease, Cadmium, Chromium, Iron, Lead, and Sodium. The test result after treatment and statistical analysis indicates that the best bed height was 5 inches due to the most reduction of physicochemical properties. Most of the resulted values of the untreated greywater in terms of physical, chemical and heavy metals were qualified for the effluent standards of DENR and WEPA. The best height considered was in 5 inches due to the high difference made compared to the other height of activated carbon in treated domestic greywater. There is a significant difference on the physicochemical properties of greywater before and after treatment at its best height of activated carbon in the filter medium. There is a significant difference on the physicochemical properties of the treated greywater with the DENR and WEPA effluent standard for water.

Keywords: activated carbon, adsorption*, Coffea liberica,* domestic greywater, spent coffee grounds

EST-19

THE POTENTIAL APPLICATION OF MINING WASTES AND SLAG AS RADIATION SHIELDING: A CHARACTERIZATION STUDY USING EPIXS

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The inclusion of nuclear energy in the Philippines' energy mix raises the prospect of the country developing a nuclear power program. More than ever, there is a need for a waste management system that includes a mechanism for disposing of low-level radioactive waste (LLW) and short-lived intermediate-level radioactive waste (ILW). A near-surface disposal facility needs to be built on or below the ground's surface with proper embankment, a protective covering that is stable and thick enough to shield ionizing radiation emitted by the radioactive wastes. The country's mining industry generates a lot of mine wastes and byproducts. Repurposing provides an alternative and promising approach to reduce these wastes.

In this study, mine wastes and mine byproducts (e.g., copper-mine tailings, ferronickel slag, gold-mine tailings, and nickel mine waste) from different sites in the Philippines were characterized for radiation shielding properties using the EPICS2017 photoatomic library and interpolated by the EpiXS software for potential use as LLW and ILW embankment. EpiXS was downloaded from the Philippine Nuclear Research Institute's website. The density and the chemical composition of the mine wastes with their corresponding weight percentages were inputted in the user interface to calculate the different shielding parameters of the material which includes photon cross sections (σ), mass attenuation coefficients (MAC), linear attenuation coefficients (LAC), mean free path (MFP), half-value layer (HVL), effective atomic number (Z_{eff}), effective electron density (N_{eff}), and exposure buildup factors (EBF).

The nickel mine waste has the highest cross section among the mine wastes considered due to its high Fe_2O_3 content. The MAC in the low gamma energy range of 662 to 1332 keV were ranked as follows: gold-mine tailing > ferronickel slag > copper-mine tailing > nickel mine waste. However, at energy (E) > 10^4 keV, nickel mine waste has the highest MAC values. Due to its large cross-section and density, ferronickel slag - except for other mine wastes without a specified density - has the highest LAC, the smallest MFP, and the lowest HVL. The HVL values of ferronickel slag for energies 356, 662, 1173, and 1332 keV are 2.2134, 2.8955, 3.8145, and 4.0714 cm, respectively. When compared to other mining wastes, nickel mine waste has the highest Z_{eff} and the highest N_{eff}, except for photon energies between 4 and 8 keV. The photoelectric predominance region has the lowest EBF values for all the mine wastes considered while the Compton scattering predominance region has the greatest EBF. Among them, the nickel mine wastes would be the best embankment material for LLW and ILW in terms of attenuating X-rays and gamma rays, which have a comparable shielding characteristic with Portland cement.

Keywords: EpiXS, gamma-rays, mine wastes, photon shielding, radioactive waste embankment

HEALTH SCIENCES

HSD-01

CYTOTOXIC AND ANTI-INFLAMMATORY SYNTHETIC CYCLOPENT-2-ENONES WITH NRF2 MODULATING EFFECTS AND INHIBITORY ACTIVITIES ON NF-KB AND IL-6 AS POSSIBLE ANTICANCER AND ANTI-INFLAMMATORY DRUG CANDIDATES

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Within the tumor microenvironment (TME) of many types of cancer, an inflammatory environment is sustained by the recruitment of immune cells that release pro-inflammatory signals and the constitutive activation of the Nrf2 (nuclear factor-erythroid 2-related factor 2) and NF-κB (nuclear factor kappa-light-chain-enhancer of activated B cells) signaling pathways within cancer cells. The Nrf2 transcription factor induces the expression of cytoprotective antioxidant genes protecting cells from damaging reactive oxygen species (ROS) and xenobiotics which is useful as an antioxidant response in normal cells, but the constitutive activation of Nrf2 found in many types of cancer confers cytoprotection from chemotherapeutic agents. The NF-κB transcription factor on the other hand is the central regulator of inflammation and induces the expression of pro-inflammatory genes including cytokines such as IL-6, but NF-κB is also known to promote tumorigenic capabilities such as cell proliferation, cell survival, angiogenesis, cell invasiveness and metastasis. Here we report synthetic 4-substituted cyclopent-2-enones with cytotoxic and antiproliferative activities, Nrf2 modulating activity, and anti-inflammatory activity through the inhibition of NF-κB and IL-6. Nine (9) novel derivatives were screened for their antiproliferative activity (GI_{50}) against HUVEC and K-562 cells, cytotoxic activities against HeLa cells (CC_{50}), as well as their effect on Nrf2, NF-κB, and IL-6 via cell-based luciferase reporter assays. The results show that the 4-substituted cyclopent-2-enones have moderate to high cytotoxicity and antiproliferative activity, with 4-(2-oxo-2-phenylethyl)cyclopent-2-en-1-one also exhibiting selective inhibition of Nrf2 in the cancer cell line Huh7, and inhibition of NF-κB and IL-6 in RAW 264.7 cells. The derivative 5-(4-oxocyclopent-2-en-1-yl)furan-2(5*H*)-one on the other hand showed potent activation of Nrf2 in HaCaT cells, aside from its inhibition of NF-κB and IL-6, and induction of the Nrf2 target gene heme oxygenase 1 (HO-1) at 10 µM as shown by Western blot analysis. This points to the cyclopent-2-enone group being an effective scaffold for anticancer and anti-inflammatory drug designs. Further functionalization of the 4-substituted cyclopent-2-enones may warrant further research.

Keywords: cyclopent-2-enone derivatives, inflammation, Nrf2, NF-κB, IL-6

HSD-02

FOOD AND NUTRITION PATTERNS OF FILIPINO PREGNANT AND LACTATING WOMEN IN 2018 AND 2019

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Due to the limited studies focusing on micronutrient intakes of women of reproductive age, and important dietary sources in the Philippines, this study aims to provide an insight into the food and nutrient consumption pattern of pregnant and lactating women. The objectives were to (1) describe the macro- and micronutrient intakes of these women; (2) assess the adequacy of these intakes against dietary references; and (3) identify important food sources of their energy and nutrient intakes. This study involved a cross-sectional secondary analysis of the data of 1,474 pregnant women and 4,571 lactating mothers covered in the 2018-2019 Expanded National Nutrition Surveys (ENNS). Socio-demographic and economic, anthropometric, including dietary data were merge and analyzed in the study.

Dishes predominantly consumed by pregnant and lactating women were comprised of rice and rice products, fish and products, and vegetables, as they were the top 3 commonly consumed foods. Mean intakes of protein, and most micronutrients, except niacin and phosphorous, were below the estimated average requirement set by the Philippine dietary reference intakes. Majority of the pregnant (85.7%) and lactating (88.4%) women had energy intake below the recommended energy intake. The proportion of pregnant women (PW) and lactating women (LW) meeting the estimated average requirements for iron (PW: 0.5%; LW: 0.6%), calcium (PW: 10.8%; LW: 9.1%), vitamin A (PW: 8.4%; LW: 5.5%), and vitamin C (LW: 4.8%) were all below 10.0%. Rice and rice products were the most important dietary sources of energy, protein, iron, thiamin, riboflavin, niacin, and phosphorus in the diet of pregnant women and lactating mothers.

These women had inadequate intake of energy and micronutrients which can be attributed to poor diet quality, and dietary sources. Factors causing poor intakes should be identified to craft dietary interventions that can improve diet quality and nutritional adequacy.

Keywords: Filipino women of reproductive age, pregnant and lactating women, energy intake, nutrient intake

HSD-03

EARLY DETECTION OF NASOPHARYNGEAL CANCER THROUGH ARTIFICIAL INTELLIGENCE USING FTIR SIGNALS OBTAINED FROM BLOOD PLASMA

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The 5-year overall survival rate for nasopharyngeal cancer (NPC) remains at about 80% if detected in its early stages. However, patients in more advanced state have a poorer survival rate, coupled with significantly higher risk of distant metastasis. Thus, the early detection of NPC is a key strategy in reducing its mortality rate and improving the patient's overall treatment response. Current screening techniques for NPC are invasive in nature, impractical due to its cost, provides long waiting time, and can even be limited due to the inaccessibility of the cancer site. Hence, the need to develop a more rapid, cost-effective, sensitive, specific, and less invasive method for screening NPC. Attenuated total reflection Fourier transform infrared (ATR-FTIR) spectroscopy has been proven in a number of studies as a highly sensitive and specific method for diagnosing cancer using tissue samples. In the current study, plasma samples from NPC patients and their age- and sex-matched clinically healthy controls were subjected to FTIR spectroscopy to determine the potential of this technique for screening NPC. Further, various classification models were trained and tested to distinguish between NPC cases and clinically healthy controls based on their spectral absorbance (*n*=104; 52 NPC cases, 52 clinically healthy). Specifically, seven (7) classification models were considered – artificial neural networks (ANN), support vector machines (SVM), decision trees, linear discriminant analysis (LDA), logistic regression, naïve bayes, and random forest. Each model was evaluated up to 10 trials, and the performance metrics – accuracy, area under the curve (AUC), positive predictive value (PPV), negative predictive value (NPV), specificity rate (SR), and recall rate (RR) – were averaged for comparison. Exploratory data analysis was performed to identify significant biomarkers and differences between the benign and malignant classes. Among the classification models, the ANN model significantly outperformed the other models, having an area under the curve (AUC) of 94.475% QUOTE 3.40%, and an accuracy of 85.42% QUOTE 5.61%. This study also identified the significant peak differences between the two groups (NPC versus healthy plasma) along the amides, lipids, carbohydrates, glycogen, and phosphorylated proteins groups. In conclusion, FTIR spectroscopy of plasma samples is potentially a specific, sensitive, less invasive, and less expensive alternative for screening NPC.

Keywords: FTIR spectroscopy, nasopharyngeal cancer, plasma, early detection, artificial intelligence

HSD-04

IMMUNOGLOBULIN GAMMA AND ALPHA RESPONSES OF BALB/C MICE AGAINST THE RECEPTOR BINDING DOMAIN OF THE SARS COV-2 SPIKE PROTEIN EXPRESSED IN *Saccharomyces boulardii*

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Despite the perceived endemic stage of the Corona Virus Disease 2019 (COVID-19) pandemic due to continued vaccinations and improved disease management, diagnosis, and therapy; the development of alternative SARS-CoV-2 vaccines remains a major priority especially in developing countries like the Philippines. The development of low-cost and shelf-stable SARS-CoV-2 vaccines that is as efficient, effective, and safe, will be an invaluable alternative in low-income countries. We immunized BALB/c mice with recombinant *Saccharomyces boulardii* transformed with a recombinant plasmid containing the SARS-CoV-2 RBD peptide. In this study, we demonstrated the production of immunoglobulin gamma (IgG) in BALB/c mice administered with recombinant *Saccharomyces boulardii* through oral gavage. IgG production was evident on the 2nd week after initial immunization in 5 out of 6 mice administered with the immunogen. Increased levels of IgG production were observed two weeks after the booster immunization. We likewise monitored the production of IgA among the *Saccharomyces boulardii* – immunized mice. Five out of the six BALB/c mice exhibited detectable levels of IgA on the 4th week of immunization. The study demonstrated the capacity of oral administration of recombinant *Saccharomyces boulardii* to induced IgG and IgA production in BALB/c mice thus a good candidate for the development of oral SARS-CoV-2 vaccine.

Keywords: COVID19, SARS-CoV2, *Saccharomyces boulardii,* oral vaccine

HSD-05

IN SILICO AND IN VIVO EVALUATION OF THE ANTI ALZHEIMER'S ACTIVITY OF BERBERINE

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Dementia, commonly caused by Alzheimer's disease (AD), is among the leading causes of deaths worldwide. To date, there is no effective cure for this progressive neurodegeneration. Considering the cons of conventional therapeutic options, as well as the multi-factorial nature of the disease pathogenesis, another potential option is the natural plant compound berberine (BBR), which boasts numerous pharmacological activities including anti-inflammation, antioxidant, and neuroprotection. Hence, in the hopes of providing useful insights, this study aims to evaluate the effects of BBR on learning and memory via in silico and in vivo methods. Molecular docking outcomes revealed good binding affinity of BBR with all selected druggable target proteins involved in AD, with the greatest activity against acetylcholinesterase. The in silico ADMET study showed that BBR has good gastrointestinal absorption, blood-brain barrier permeation, and drug-likeness. The acute toxicity study in adult zebrafish revealed the approximate lethal dose of BBR to be 500 mg/L. Concentrations of 1, 10, and 100 mg/L caused behavioral changes of increasing intensity, while higher concentrations (500 to 1,500 mg/L) resulted in death within 2 to 24 hours post-exposure. Based on the results of the T-maze test, zebrafish learning and memory was affected by zinc chloride exposure in a dose-dependent trend from 1 to 2.5 mg/L, however the higher dose of 5 mg/L did not follow the trend but rather caused more freezing or latency to movement. Using concentrations selected based on the tests mentioned, the inhibitory avoidance test was carried out wherein the fish must learn and remember to avoid entering the area where a shocking stimulus is administered. The results showed that, in comparison to the untreated control group, zebrafish learning and memory was impaired by exposure to 2.5 mg/L zinc chloride but this impairment was lessened by simultaneous exposure to either 100 mg/L BBR or 2.5 mg/L donepezil. Further trials will be performed to evaluate behavior and biomarkers in vivo, as well as enzyme activity inhibition using screening kits.

Keywords: Berberine, Dementia, Molecular docking, Zebrafish, T-maze, inhibitory avoidance

HSD-06

LC-MS-BASED METABOLITE PROFILING, ANTIMICROBIAL, AND ANTIOXIDANT ACTIVITIES OF *Kanapia monstrosa* (Rubiaceae) ETHANOLIC LEAF EXTRACT

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The Philippines is known for its rich and extensive plant diversity. Many of these are uninvestigated endemic plant species that could be utilized as natural sources of bioactive compounds and therapeutic agents for the treatment of infectious and wide array of diseases. *Kanapia monstrosa* (A. Rich) Arriola & Alejandro is an unexplored endemic Philippine *Rubiaceae* that belongs to the newly classified *Kanapia* genus (2016) from the tribe *Vanguerieae*. This study is first to report the phytochemical screening and liquid chromatography-mass spectrometry analysis (LCMS) of *K. monstrosa* ethanolic leaf extract that was carried out using the UNIFI data analysis software. The distinct peaks were subjected to library matching using the Waters Traditional Chinese Medicine (TCM) library. Moreover, the study aimed to evaluate its potential antimicrobial and antioxidant activity using Kirby Bauer disc diffusion method and DPPH-radical scavenging assay, respectively. The qualitative phytochemical screening revealed different phytoconstituents such as flavonoids, phenolic compounds, saponins, steroids and terpenoids, and tannins. Supplementarily, the LC-MS analysis of *K. monstrosa* ethanolic leaf extract identified nine putative components, namely: phenylpropionic acid (1), apocynoside I (2), rutin (3), quercetin-3-O-β-D-glucopyranoside (4), cimicifugic acid A (5), apigenin-7-O-α-L-rhamnose(1→4)-6"-O-acetyl-β-D-glucoside (6), pentacosanoic acid (7), stellasterol (8) and 25-O-acetyl-7,8-didehydrocimigenol-3-O-β-D-xylopyranoside (9) which majority have documented antibacterial and antioxidant properties. Moreover, *K. monstrosa* ethanolic leaf extract yielded strong antimicrobial activity against *E. coli*, *E. faecalis*, *S. aureus*, and *C. albicans* based on 24-hour observation period. In addition, it exhibited moderate antioxidant activity with an IC_{50} value of 236.30 µg/mL. The obtained results complements the LC-MS-detected putative compounds of *K. monstrosa* leaf extract. This study provides an opportunity to investigate other pharmacological activities and conduct in-*vivo* animal studies that are reflected in the phytochemical profile.

Keywords: K. monstrosa, phytochemicals, antimicrobial, evaluation, LCMS

HSD-07

MORPHOLOGICAL AND PHYTOCHEMICAL VARIATIONS OF ROSELLE (*Hibiscus sabdariffa* L.) GERMPLASM FROM THE PHILIPPINE BIOREPOSITORY NETWORK (PBN)

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Roselle (*Hibiscus sabdariffa*) is an important plant food-medicine, owing to its medicinal properties, nutraceutical potential, and booming utilization as a beverage crop. To explore genetic variability which can be ventured for the improvement of roselle production and utilization, four (4) pre-selected accessions representing the distinct morphotypes of the thirty-two (32) accessions under the PBN program were evaluated for their morphological and phytochemical properties. We characterized the germplasm using the roselle descriptor list, and evaluated the phytochemicals present, antioxidant activity, and proximate composition. The four accessions have marked variations in growth habit, number of branches, stipule color, leaf petiole color, leaf base shape, degree of pubescence, petal color, epicalyx color and lobe shape, calyx shape, upper and lower calyx lobe, and fruit shape. We observed differences in % scavenging activity (1.52 ± 0.85 to 3.42 ± 0.85), % ash (0.61 ± 0.45 to 1.49 ± 0.45), % moisture (89.55 ± 0.5 to 90.62 ± 0.5), and % crude protein (5.47 ± 2.13 to 8.17 ± 2.13). Although PBN 2018-018 and PBN 2018-005 contained flavonoids, there was a significant difference in their total phenolic content with PBN 2018-018 (0.56 ± 0.03 mg GAE/g) being the highest and PBN 2018-005 (0.21 ± 0.03 mg GAE/g) being the lowest. The variations in morphology were reciprocally illuminated in the phytochemical properties of the selected accessions planted on the same field; hence, there was a strong indication of intraspecific genetic variability in the roselle germplasm collection. This provides useful information about these accessions that could be utilized for the genotypic selection, standardization and breeding of roselle as food-medicine.

Keywords: characterization and evaluation, food-medicines, functional food, genetic variability, nutraceutical

HSD-08

PHYTOCHEMICAL AND PHARMACOLOGICAL PROFILE OF TEA EXTRACTS FROM CAT'S WHISKERS' LEAVES (*Orthosiphon aristatus* (BLUME) MIQ.)

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Cardiovascular diseases (CVDs) are a class of diseases deemed as the leading cause of death and morbidity within the global scale. Thrombosis and chronic inflammation are connected to CVDs as they are both cardiovascular risk factors. Herbal plants are now commonly sought for drug discovery and natural products because of its bioactive compounds. *Orthosiphon aristatus* is a plant that is widely distributed in Southeast Asia and is traditionally used as an herbal tea in the Philippines. Only few literatures about its aqueous leaves extract are existent, thus phytochemical screening and assessment of its pharmacological activities were conducted. Standard Qualitative Test was utilized in phytochemical analysis, Brine Shrimp Lethality Assay for toxicity, *in vivo* thrombolytic assay (Tail-Tip Bleeding Assay) and *in vivo* chronic anti-inflammatory assay (Formalin-Induced Mice Paw Edema) for screening its biological activities. In terms of bleeding time, 3% and 1.5% *O. aristatus* tea extract surpassed the known anticoagulant heparin. Prolonged clotting times within ICR mice against normal saline was exhibited by 3%, 1.5%, and 0.75% *O. aristatus* tea extract but was found to be lower than the heparin's clotting time with only minimal deviations in measured times. Also, the 3% *O. aristatus* tea extract was the most effective in inhibiting the paw-edema (42%) which exceeded diclofenac (31%). Dose-dependency was observed in both biological activity assays. The calculated LC_{50} of *O. aristatus* was 163,153.9 μg/mL and categorized as non-toxic. Presence of triterpenes, flavonoids, alkaloids, saponins, glycosides, and tannins has a key role in the thrombolytic and chronic anti-inflammatory activity of *O. aristatus* tea extract. Hence, this tea extract can offer a safe and effective treatment for thrombosis and chronic inflammation related to CVDs.

Keywords: *O. aristatus*, tea extract, phytochemicals, chronic anti-inflammatory, thrombolytic activity

HSD-09

PHYTOCHEMICAL EVALUATION OF TWO *Senna alata* (L.) ROXB. MORPHOTYPES

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Senna alata, or akapulko is a flowering shrub with known therapeutic applications in the Philippines. The leaves are widely used as an antifungal for skin infections. We screened the phytochemical properties of two *S. alata* morphotypes to elucidate potential variations in their bioactivity. Phytochemical analyses were conducted to characterize and differentiate selected *Senna alata* collections, PBN 2019-149 and PBN 2019-654, from Philippine Biorepository Network (PBN) collections, Institute of Crop Science, College of Agriculture and Food Science, University of the Philippines Los Baños. The vegetative propagules of the two accessions were planted in the field using a randomized complete block design at three replicates. Physiologically mature leaves of *S. alata* were harvested, dried, ground, and extracted using methanol as solvent. The samples were subjected to phytochemical screening, antioxidant assays and proximate analysis. Saponins were detected only in PBN 2019-654. Flavonoids and tannins were abundant while alkaloids were present at weaker concentrations in both crude extracts at 5mg/mL. The crude protein of PBN 2019-654 (18.97%) is significantly greater than PBN 2019-149 (16.23%), while other proximate compositions had no significant differences between the accessions. PBN 2019-654 exhibited higher antioxidant activity, with 72.38% scavenging activity and 0.4717 mg GAE/g phenolic content, when compared to PBN 2019-149 with 20.34% scavenging activity and 0.0488 mg GAE/g phenolic content. Hence, differential yet consistent antioxidant activity was evident in both assays, suggesting differential phytochemical expression of the two morphotypes planted in the same field. This further indicated that there were intraspecific genetic differences between the two accessions. We recommend revisiting the raw materials used by the herbal industry to improve and sustain the commercial quality of *S. alata* herbal products through genotypic standardization.

Keywords: *Cassia alata*, genotypes, intraspecific diversity, medicinal plant, phytochemicals

HSD-10

PHYTOCHEMICAL SCREENING AND DEVELOPMENTAL EFFECTS OF TWO ETHNOMEDICINAL PLANTS, *Anodendron borneense* (KING & GAMBLE) D.J. MIDDLETON AND *Hyptis capitata* (Jacq.), ON MALLARD DUCK EMBRYOS

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Plants are valuable sources of compounds that can be used for developing medicines against various diseases. The Manobo tribe in Agusan del Sur has been using *Anodendron borneense* (King & Gamble) D.J. Middleton and *Hyptis capitata* (Jacq.) as medicinal plants to treat various ailments such as cuts, wounds, and probable cancer-related ailments. However, studies on these plants are very limited despite their ethnomedicinal importance. The present study determined the phytochemical constituents of the ethanolic extracts of *A. borneense* stem and *H. capitata* leaves and investigated their developmental effects on Mallard duck (*Anas platyrhynchos*) embryos. Qualitative phytochemical screening was used to determine the secondary metabolites of the plants, while chorioallantoic membrane (CAM) assay was used to investigate the developmental effects of the ethanolic extracts on duck embryos. Eight-day-old duck embryos were treated with different concentrations (1, 10, 100, 1000, and 10000 ppm) of the two plant extracts for 72 hours. The branch points on the CAM were counted, and the embryo's morphological biometrics, including weight, eye diameter (ED), crown-rump length (CRL), head-beak length (HBL), forelimb length (FL), and hindlimb length (HL) were measured. Phytochemical screening revealed that these plants contain no alkaloids, but steroids, flavonoids, saponins, and tannins are present. The extracts were antiangiogenic as indicated by the significantly lower branch points in the CAM blood vessels compared to the negative control. CAM assay also showed a dose-dependent decrease in angiogenesis as the concentration of the extracts increased, especially at 1000 and 10000 ppm ($P<0.05$). Probit regression analysis revealed Inhibitory Concentration at 50% (IC50) of 6386 ppm and 21169 ppm for *A. borneense* stem and *H. capitata* leaf extract, respectively. There were no detectable abnormalities in the gross appearance of the embryos. Further, no significant effects on the morphological biometrics in the embryos treated with the *H. capitata* leaf extract. However, the weight, ED, CRL, FL, and HL of embryos treated with *A. borneense* stem ethanolic extract significantly decreased these morphological endpoints. Pearson correlation analysis also revealed that the decrease in CAM angiogenesis has a moderate positive correlation with weight, CRL, and ED and a weak correlation with HBL and HL. The results of this study indicate the antiangiogenic activity of *A. borneense* stem and *H. capitata* leaf ethanolic extracts on the CAM of duck embryos. Further studies can be conducted to elicit the identified phytochemicals' role in CAM angiogenesis and duck embryo development.

Keywords: Manobo, Ethnobotany, CAM assay, angiogenesis, developmental biology

HSD-11

RELATIONSHIP OF MATERNAL DIET AND PHYSICOCHEMICAL COMPOSITION OF HUMAN MILK AT 0 TO 4 MONTHS

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Understanding the composition of human milk results in understanding the biology of the growing infant. Numerous studies for the past forty years have demonstrated that demographic, physiologic, and environmental factors can affect the chemical composition of human milk.   One of the obvious yet underdetermined factor is maternal diet.   Depending on the type of nutrient, some nutrients may exert minimal influence while for other nutrients, maternal diet can result in large variations.   The relationship of maternal diet on the physicochemical composition of human milk of lactating Filipino women of varying body mass index (BMI) during their first four months of lactation was evaluated.   Using a cohort, semi-longitudinal study design, breastmilk samples, socio-demographics, and diet recalls were collected from 34 healthy Filipino lactating women classified according to their BMIs (underweight n=7; normal weight n=16; and overweight n=11).   Proximate and physicochemical compositions of the milk samples were measured which included total protein, total fat, moisture, ash, pH, and total soluble solids (TSS).   The carbohydrate content of the milk samples was calculated by difference, using data from the previously analyzed proximate composition.   All 34 lactating participants were interviewed three times each month to obtain their 24 h food recalls.   Descriptive statistics were used to describe the study population, physicochemical characteristics of the breast milk samples, and dietary intake of the participants.   Pearson Chi-square was used to determine association between variables.   Results show that the nutrient indexes for each weight classification throughout the four months were not significantly different from one another.   As for the physicochemical composition of the milk samples, generally, values at the first month were highest and the lowest values were obtained on the fourth month. The crude fat content of the human milk were found to be associated with the fat intake of the participants while the maternal dietary fat intake was associated with the pH values of the human milk samples.   The results suggest that maternal diet can shape the physicochemical quality of human milk. More research is needed to substantiate this relationship.

Keywords: breastmilk composition, maternal diet, proximate composition, body mass index, lactation

HSD-12

SYNTHESIS AND 3D CYTOTOXICITY OF MULTIFUNCTIONAL SILICON NANOPARTICLES

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Mesoporous silicon nanoparticles (NPs) have attracted considerable attention in the field of biomedical drug delivery owing to their properties such as in vitro biocompatibility, in vivo biodegradability, and high photothermal activity. Recently, anticancer drugs such as paclitaxel and doxorubicin were loaded into porous silicon (PSi) NPs coated with Pluronic F-127, PEG, and hyaluronic acid layers. However, poor targeting to specific organs limited their applications to cancer therapy. In this study, the synthesis and functionalization of fluorescent mesoporous silicon (FMPSi) NPs decorated with graphene oxide (GO) nanosheets was reported. The GO-wrapped FMPSi (FMPSi@GO) was loaded with a cisplatin (Cis) to yield the Cis-loaded FMPSi@GO (FMPSi-Cis@GO). This was further conjugated with dequalinium to obtain the nanoparticle FMSi-Cis@GO@DQA. The 2D cytotoxicity utilizing Cell Titer Glo Luminescence assay showed that FMSi-Cis@GO and FMSi-Cis@GO@DQA inhibited the proliferation of HeLa and SH-SY5Y cells with IC_{50} ranging from 24 – 32 µg/mL. Interestingly, both NP is non-selective to HEK-293 cells ($IC_{50} > 100$ µg/mL). In lieu of in vivo studies, the NPs were subjected to 3D cytoxicity assay. A 3D cell viability of tumor cells is considered as more stringent model in in vitro drug screening as 3D cell cultures acquire several in vivo characteristics of cancer cells. FMSi-Cis@GO@DQA clearly inhibited the 3D spheroidal SH-SY5Y cells using 12.5 – 100 µg/mL concentration, while using HEK-293 showed inhibition at 200 – 500 µg/mL concentration.

Keywords: nanoparticle, mesoporous silicon, 3D cytotoxicity, cell viability

MATHEMATICAL AND PHYSICAL SCIENCES

MPS-01

ASSESSMENT OF HOMOGENEITY AND STABILITY OF A CANDIDATE REFERENCE MATERIAL FOR TOTAL HARDNESS IN WATER USING VALIDATED AUTOMATED PHOTOMETRIC TITRATION METHOD

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Water is described as hard when it contains high amounts of mineral ions which is primarily calcium and magnesium ions. It is typically expressed as the concentration of calcium carbonate in water. Quantifying total hardness in water is essential as it may affect human health, infrastructures, and industries. However, based on the list of the Philippine Accreditation Bureau, only a few accredited water testing laboratories can perform total hardness analysis. Also, there is no locally available reference material (RM) for total hardness in water. In this study, the homogeneity and stability of the locally developed candidate reference material for total hardness in water were assessed using validated automated photometric titration with an ethylenediaminetetraacetic acid (EDTA) as the titrant and eriochrome black T (EBT) as the indicator. Amounts of calcium carbonate and magnesium oxide were dissolved in acidified deionized water. The prepared solution was homogenized, transferred into acid-washed narrow-mouthed 250 mL HDPE bottles, and stored at 4 ± 2 °C. Sample preparations were done gravimetrically, and analyses were performed using a validated automated photometric titration method. The prepared RM passed the homogeneity tests using ANOVA ($F_{calc} < F_{crit}$: 2.30), wherein 11 bottles were selected through stratified random sampling and were analyzed in triplicate, and the obtained F_{calc} value is 2.08. Stability studies were evaluated using trend analysis by linear regression. A short-term stability study was conducted for three weeks, and the RM was found stable for transport under ambient conditions. The prepared RM also proved stable for long-term stability assessment for 3 months at 4 °C. The findings suggest that the candidate RM was successfully produced and initially passed for homogeneity and stability based on ISO Guide 35:2017. The candidate RM shows highly potential usage in quality control checks and method validation carried out by local water testing laboratories in the determination of total hardness in water samples.

keywords: total hardness, water, automated titration, reference material

MPS-02

ASSESSMENT OF POTENTIALLY TOXIC ELEMENTS IN TOTAL SUSPENDED SOLIDS IN GROUNDWATER SAMPLES IMPACTED BY A LEGACY MERCURY MINE

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Previous study on water quality within the vicinities of the abandoned mercury mine in Puerto Princesa City, Palawan assessed the potentially toxic elements (PTE) in the groundwater. In this study, the concentration of PTEs, specifically of arsenic (As), cobalt (Co), copper (Cu), iron (Fe), manganese (Mn), nickel (Ni) and zinc (Zn) in total suspended solids (TSS) of groundwater samples were measured in order to determine which of the elements occur in solid form and can be easily filtered out. Groundwater samples were collected from six (6) monitoring wells during both dry (March 2022) and wet season (August 2022). The suspended solids were obtained by filtering the groundwater samples in a vacuum filtration setup equipped with 0.45 μm pore size membrane filter paper. The filtrands were analyzed using SciAps X-300 portable x-ray fluorescence spectrometer to measure PTE concentrations. Mean PTE concentrations from samples collected during dry season measured 2 mg kg^{-1} As, 479 mg kg^{-1} Co, 112 mg kg^{-1} Cu, 41,525 mg kg^{-1} Fe, 1,706 mg kg^{-1} of Mn, 2106 mg kg^{-1} Ni, and 54 mg kg^{-1} Zn. While wet season samples recorded 5 mg kg^{-1} As, 19 mg kg^{-1} Co, 13 mg kg^{-1} Cu, 3,406 mg kg^{-1} Fe, 99 mg kg^{-1} of Mn, 56 mg kg^{-1} Ni, and 90 mg kg^{-1} Zn. Comparison using independent samples t-test between the PTE concentrations from dry and wet season shows significant differences among all PTE (p-values > 0.05) with dry season samples showing higher PTE concentrations. PTE concentrations of the TSS reflect characteristic composition inherent with laterite-rich soils and ultramafic bedrock of Puerto Princesa City.

Keywords: potentially toxic elements, total suspended solids, groundwater, abandoned mine

MPS-03

CARBOXYLIC ACID-FUNCTIONALIZED CHITOSAN SYNTHESIZED FROM SEAFOOD WASTE FOR THE REMOVAL OF METRONIDAZOLE IN AQUEOUS SOLUTIONS

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Metronidazole and other antibiotics are found in aquatic environments. These have the potential danger of ending up in our drinking water and may lead to detrimental effects. The use of chitin, chitosan, and their derivatives as biosorbents has attracted global attention due to their availability, non-toxicity, and the presence of amino and hydroxyl groups which can act as adsorbents for various water pollutants. Moreover, these may be sourced from seafood waste which makes them a remarkable resource. In this study, the adsorption capacity and % removal of chitin, chitosan, and the synthesized carboxylic acid-functionalized chitosan for metronidazole were assessed. The FTIR spectra of the three biopolymers revealed their successful syntheses from crab and shrimp shell waste products. Furthermore, the degree of deacetylation for the synthesized chitosan and carboxylic acid-functionalized chitosan was calculated to be 83.209% and 72.163%, respectively. It was also found that the adsorption capacity and the % removal increased from chitin to chitosan, and to the chitosan derivative. The average calculated % removal of chitin, chitosan, and functionalized chitosan are 8.269%, 17.071%, and 20.823%, respectively, indicating the significance of the functionalization to the adsorption capacity of chitosan. Finally, it was found that the Langmuir isotherm fits the best for chitin and the Redlich-Peterson isotherm for the chitosan and functionalized chitosan.

Keywords: chitosan, seafood waste, valorization, metronidazole, adsorption

MPS-04

CHANGES IN GRAIN COMPOSITION AND PHYSICOCHEMICAL PROPERTIES OF LOS BAÑOS *LAGKITAN* CORN GRITS AFTER NIXTAMALIZATION

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The increasing consumption of white corn in developing countries like the Philippines makes it necessary to adopt food processing techniques aimed at maximizing its nutritional and health benefits. Nixtamalization is a method where corn kernels are cooked and steeped in alkaline solution prior to food preparation. Remarkable changes have been reported regarding the properties of Los Baños *Lagkitan* (LKN) corn kernels after nixtamalization but to date, nixtamalization of Philippine corn grits has not yet been investigated. This study determined the effect of nixtamalization on the grain composition and physicochemical properties of LKN corn grits. The optimized nixtamalization conditions (i.e., 5:1 water:corn grits ratio, 10-min cooking time, 0.82% w/v calcium hydroxide, and 8 hours steeping time) were adopted in the study followed by analysis of the grain components and physicochemical properties of the raw and nixtamalized samples. Results showed that raw LKN corn grits generally had higher amounts of grain macronutrients and resistant starch than the nixtamalized counterpart except for Ca (693.68 ± 20.09 mg/100 g), Zn (1.16 ± 0.09 mg/100 g), moisture ($11.61 \pm 0.11\%$) and ash ($3.58 \pm 0.02\%$). Crude fiber, crude fat, and resistant starch levels were significantly reduced after nixtamalization while an increase in apparent amylose content was observed. Changes in the thermal properties of LKN corn grits after nixtamalization suggested partial gelatinization, retrogradation, and annealing of starch during the process. The magnitude of variations in the levels of selected grain components and physicochemical properties of corn grits upon nixtamalization were notable compared to previous results on nixtamalized corn kernels and this is the first report on the properties of nixtamalized corn grits of a commonly consumed Philippine waxy corn variety. Nutritional studies on nixtamalized corn grits, including nutrient bioavailability, blood glucose- and lipid-lowering effects, would be beneficial in developing this commodity as a potential alternative health-promoting staple in the country.

Keywords: corn grits, grain composition, Los Baños *Lagkitan*, nixtamalization, physicochemical properties

MPS-05

CORN HUSK-DERIVED CELLULOSE-POLYETHYLENE GLYCOL COMPOSITE FILMS AS POTENTIAL FOOD PACKAGING MATERIAL

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Corn husk, an agricultural waste, is composed of 50-55% cellulose. Cellulose possesses several desirable properties such as high thermal stability, high tensile strength and high modulus, and biocompatibility. Due to these properties, it is widely used as a reinforcing material in composites. In this study, corn husk-derived cellulose was used as a reinforcing material in polyethylene glycol (PEG) composite films. Cellulose was extracted from corn husks by alkali treatment and subsequent bleaching. Removal of non-cellulosic materials from the corn husks and thus, the successful extraction of cellulose, was confirmed using Fourier Transform Infrared (FTIR) spectroscopy. Varying concentrations of cellulose (0, 2.5, 5, and 10wt%) were incorporated in PEG. The composite films were then prepared via solution casting. The composites were characterized using thermomechanical analysis (TMA) and thermogravimetric analysis/differential scanning calorimetry (TGA/DSC) for the determination of their degradation temperatures and glass transition temperatures, respectively. Data from TMA and TGA/DSC showed that incorporation of 2.5wt% cellulose in PEG increased the degradation temperature and glass transition temperature of the composite by 5.92°C and 2.4°C, respectively. These findings show that the thermomechanical properties of PEG composite films can be enhanced using corn husk-derived cellulose as reinforcement material. Given the versatility of possible modifications using cellulose as a reinforcement material and the antimicrobial properties of PEG, PEG/cellulose composite films can then be tailored to specific applications such as food packaging materials.

Keywords: corn husk, cellulose, polyethylene glycol composite films, degradation temperature, upcycling

MPS-06

EFFECT OF MOLECULAR MASS OF POLYMER ON STABILITY AND PHOTOCATALYTIC ABILITY OF REDISPERSED ZNO/POLY(ACRYLIC ACID) NANOCOMPOSITES

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Photocatalysis is one of the most common remediation techniques to dye pollution. Metal oxide nanocomposites show great promise in this field. However, their use is limited due to problems in stability brought about by agglomeration. Redispersion and polymer-capping are two solutions to the challenge of producing nanocomposites which are stable. In line with this, the study is pursued to fill the research gaps on the influence of molecular weight of a specific polymer stabilizer to contribute to the improvement of large-scale production of photocatalysts. In this study, ZnO nanoparticles were synthesized via sol-gel method with the in *situ* addition of varying molecular weights (5100 g/mol, 450000 g/mol, and 1.25 million g/mol) of polyacrylic acid (PAA) as a polymer capping agent. Characterization of the synthesized products was performed via FTIR and XRD analysis which revealed high purity and good crystallinity. The calculated band gap energies also minimally deviate relative to the theoretical value for bare ZnO. Meanwhile, the degradation of tartrazine under UV light reached 84.3%, 83.2%, 84.1%, and 85.4% for bare ZnO, ZnO/PAA-5100, ZnO/PAA-450000, and ZnO/PAA-1.25M, respectively. The photodegradation of tartrazine in the presence of the synthesized ZnO/PAA nanoparticles exhibited a first order kinetic behavior. Moreover, photocatalytic efficiencies and degradation rate constants were observed to be directly correlated with PAA molecular weight. With this, the synthesized ZnO/PAA-1.25 million was found to be the most efficient in terms of photodegradation.

Keywords: photocatalysis, zinc oxide, nanoparticles, redispersion, polymer-capping, dye pollution

MPS-07

EFFECT OF TREE SPECIES ON THE FORMALDEHYDE EMISSION OF PLYWOOD

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Formaldehyde emission (FE) in wood-based panels such as plywood are regulated worldwide due to its harmful effect on human health. According to the International Agency for Research on Cancer of the World Health Organization, inhalation of formaldehyde gas can be carcinogenic to humans. In the Philippines, the approval of the FE requirement (PNS 2103:2017) for plywood panels paved the way to investigate how tree species contributes to the FE. In this study, the effect of three industrial plantation tree species was investigated if they could influence the emission of formaldehyde gas. *Eucalyptus camaldulensis* subsp. *obtusa* (Blakely) Brooker, *Falcataria moluccana* (Miq.) Barneby & J W. Grimes, and *Gmelina arborea* Roxb. were veneered and manufactured into plywood. Commercial urea formaldehyde adhesive for interior-type plywood production in the Philippines was used to bond the veneers, following the manufacturer's specifications and conditions for gluing, assembly and pressing. Test methods according to PNS ISO 12460-4 was used to evaluate the FE of the produced plywood.

Results showed that tree species influence the emission of formaldehyde gas from the manufactured plywood. The obtained FE values (mg/L) were 0.63 for *E. camaldulensis*, 5.74 for *F. moluccana* and 6.25 for *G. arborea*. The maximum FE requirement to conform with the standard should be not more than 5.0 mg/L. Thus, only plywood made from *E. camaldulensis* passed the FE test according to the requirement stated in PNS 2103:2017.

E. camaldulensis is a high-density species with substantial amount of polyphenolic extracts that probably scavenged the excess formaldehyde in the UF adhesive while *F. moluccana* and *G. arborea* belong to low density with lesser extractives. The results suggest that there is a need to reformulate the existing commercial formulation of the UF resin and considered the species used for plywood manufacture. Incorporation of formaldehyde scavenger in the UF glue-mix is recommended for bonding veneer produced from tree species belonging to low density category with low quantity of extractives.

Keywords: plywood, formaldehyde emission, urea formaldehyde resin, industrial tree plantation species

FRACTIONATION OF AGUSAN RC216 RICE BRAN *(Oryza sativa)* VARIETY USING SUPERCRITICAL CARBON DIOXIDE (SC-CO$_2$)

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Another common variety of rice bran *(Oryza sativa)*, the RC216 in Caraga Region particulary in the provinces of Agusan del Norte and Agusan del Sur was subjected to supercritical carbon dioxide fractionation. Usually rice bran in this area are mainly collected for fuel in the agricultural factories or burned along the roads, instead of just using it as a fuel this study fractionated the extracts and have its fatty acid profile. Different oil extracts from three different parameters were obtained, 10 Megapascal (MPa), 20 Megapascal (MPa) and 30 Megapascal (MPa) at constant temperature of 40 degree Celsius. The highest oil yield is at 20 MPa with an average of 3.10%, followed by 30 MPa at 1.70% and 10 MPa with 1.02%. 10 MPa oil sample, the minimum pressure applied for the extracts was subjected to gas chromatography-mass spectrometry (GC-MS) analysis and found six compounds in which linoleic and tocotrienol are the major compounds, y-oryzanol were also found in the extract. For fatty acid profiling 20MPa and 30MPa samples were subjected to gas chromatography and were compared, there are ten fatty acids found in which oleic (C18:1) was the highest in terms of weight by weight for both 20MPa and 30MPa extracts. Short chain polyunsaturated fatty acids such as linoleic and linolenic were both present in 20MPa and 30MPa extracts. Arachidonic, a long chain polyunsaturated fatty acid was also present in both sample extracts.

Keywords: rice bran, RC216 variety, supercritical carbon dioxide, fatty acid, gas chromatography, mass spectrometry

MPS-09

LAHAR-DERIVED NANO-ZEOLITE ADSORBENTS FOR ORGANIC AND HEAVY METAL CONTAMINANT REMEDIATION

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The 1991 eruption of Mt. Pinatubo in the Philippines was the second-largest eruption of the 20th century. Over 30 years later, Mt. Pinatubo continues to threaten surrounding areas as typhoon and monsoon rains remobilize the remaining volcanic deposits into giant lahar flows, regularly causing deadly pyroclastic flows. Meanwhile, heavy metals and synthetic organic dyes, which are considered two major water pollutants, has been excessively introduced into bodies of water through domestic and industrial wastewater discharge, and/or acid mine drainage, imposing health risks to humans, animals, plants, and microorganisms alike. Thus, measures to mitigate these issues are of utmost concern. In this work, nano-zeolites (sodalite octahydrate) were hydrothermally synthesized using lahar as the aluminosilicate source. The adsorption performance of nano-zeolite, measured using dyes (methylene blue and fuchsine) and heavy metal ions (cobalt and copper), show improved pollutant adsorption compared to pristine lahar after 48 hours. In addition, the nano-zeolite shows preference to positively charged pollutants over neutral and negatively charged ones. Moreover, adsorption modelling reveals that both the lahar and nano-zeolite follow the Freundlich isotherm in all pollutants. This work hits two birds with one stone by upcycling threatening volcanic wastes (lahar) into a cheap source of adsorbent material that can be used for pollution mitigation.

Keywords: valorization, lahar, zeolite, dye, heavy metal, adsorbent

LIBRARY SYNTHESIS AND CHARACTERIZATION OF ANTITUBERCULAR 2-ARYLQUINOLINE ESTERS INHIBITORY TO *Mycobacterium tuberculosis* GYRASE

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The virulence of *Mycobacterium tuberculosis* (*Mtb*), the causative agent of tuberculosis, can be attributed to the emergence of multi- and extensively drug resistant strains which makes this disease a concern globally. This renders some of the current antibiotics to be ineffective against *Mtb* that can be further exacerbated by different socioeconomic factors. A potent antitubercular moiety of a class of antitubercular drugs, quinoline, is found in fluoroquinolones which inhibit *Mtb* gyrase - a type II toposiomerase that introduce negative supercoiling into DNA and crucial for mycobacterial DNA replication, transcription, and recombination. It is among the most pursued target enzymes that when inactivated causes lysis to the bacterium. Further functionalization and development of its derivatives is needed to ensure enough chemical arsenal against highly resistant *Mtb* strains. Building on our previous efforts where we discovered significant improvement of antitubercular activity through functionalization C-2 and C-6 positions of the quinoline-4-carboxylic acid (QCA) with bulky arenes and halogens/alkyl groups, respectively, we were drawn in the current study to explore the effect of alkylating the carboxylic acid moiety in enhancing antitubercular activity and inhibition to *Mtb* gyrase. A total of 40 arylated quinoline ester derivatives were synthesized and characterized from 6-chloro-2-(phenanthren-3-yl)quinoline-4-carboxylic acid and 2-([1,1'-biphenyl]-4-yl)-6-methylquinoline-4-carboxylic acid via Fischer and Steglich esterification reactions. The antitubercular activities of the compounds were assessed against fast replicating *Mtb* $H_{37}Rv$ using Microplate Alamar Blue Assay (MABA). From the MABA Minimum Inhibitory Concentration (MIC) results, 15 derivatives have potent inhibitory activities (MIC = 16 µg/mL). Moreover, ethyl 6-chloro-2-(phenanthren-3-yl)quinoline-4-carboxylate inhibited the supercoiling of *Mtb* gyrase at 100 µM and 10 µM concentrations. Molecular docking studies also revealed strong binding of the compound to the active site of the enzyme thus clarifying the mechanism of action of the ethyl ester derivative. Our results highlight the importance of structure design and functionalization chemistry to discover unique congeners relevant to the development of novel *Mtb* bacterial topoisomerase inhibitors.

Keywords: antitubercular activity, library synthesis, quinoline esters, *Mtb* gyrase, molecular docking.

MPS-11

METHOD VALIDATION OF LIQUID CHROMATOGRAPHY – ISOTOPE DILUTION MASS SPECTROSCOPY AND OPTIMIZED MONIER WILLIAMS DISTILLATION FOR THE CHARACTERIZATION OF SULFITE IN DESICCATED COCONUT PROFICIENCY TEST MATERIAL

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Sulfite is a food preservative commonly used in desiccated coconut due to its antioxidant, antimicrobial, and anti-browning properties. However, the amount of sulfite in food is regulated by government authorities due to its adverse effect when it exceeded its maximum allowable limit (MAL), the Food and Drug Administration of the Philippines has established MAL (200 mg/kg) for sulfite content in desiccated coconut. The Metrology in Chemistry (MiC) of the National Metrology Laboratory (NML) offers accuracy-based Proficiency Testing (PT) schemes to assess the capability of local laboratories in the chemical measurement of sulfite in desiccated coconut. Method validation in compliance with ISO Guide 35 was performed for both Liquid Chromatography – Isotope Dilution Mass Spectroscopy (LC-IDMS) method and the Optimized Monier Williams Distillation (OMW-D) method to characterize the PT material. In this study, gravimetric determination of sulfite (as SO_2) in desiccated coconut using LC-IDMS method and OMW-D method were assessed for different parameters such as working range, instrument detection limit (IDL), instrument quantitation limit (IQL), repeatability, and trueness by recovery. The working range for LC-IDMS is 2 – 20 mg/kg SO_2 (r= 0.998) with IDL = 0.04 mg/kg and IQL = 10.14 mg/kg. On the other hand, the IDL = 4.09 mg/kg and IQL 13.63 mg/kg were calculated using the OMW-D method. Repeatability expressed as %RSD were 0.80% (n=12) at 200 mg/kg and 2.12% (n=10) at 100 mg/kg for LC-IDMS and OMW-D method, respectively. Trueness by recovery obtained by LC-IDMS method yielded an average of 100.26% (n=9) and by the OMW-D method an average of 96.74% (n=12) was achieved. Repeatability and trueness measurements using both methods were within the AOAC acceptable criteria and indicated the accuracy of the methods. The results of the evaluated performance characteristics showed that both LC-IDMS and OMW-D methods are fit-for-purpose in characterizing sulfite in desiccated coconut PT material.

Keywords: method validation, sulfite, liquid chromatography – isotope dilution mass spectroscopy, optimized monier williams distillation, and desiccated coconut pt material

MPS-12

MG-AL-CO₃ LAYERED DOUBLE HYDROXIDES AS A REUSABLE ADSORBTIVE MATERIALS OF DYE POLLUTANTS

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Water contamination due to pollutant dyes from the textile industry has been a growing concern among scholars worldwide. Treatment of dye-polluted water includes conventional processes that are costly, complex, and unsustainable. Hence, eliminating dye contaminants using adsorbents — particularly Layered Double Hydroxides (LDH) — is being explored as a reliable, cost-effective, sustainable, and simple alternative.

In this research, Mg-Al-CO₃ LDH was synthesized through the co-precipitation method and characterized using Fourier transform spectroscopy (FTIR) and powder x-ray diffraction analysis (pXRD). The LDH adsorption was examined using Eriochrome black T (EBT) as adsorbate. The adsorption isotherm was obtained and fitted to an adsorption model. Lastly, the LDH was subjected to a reusability assay.

The FTIR spectrum showed OH stretch peaks and asymmetric carbonate stretch peaks, which confirmed the synthesis of a layered structure with interlayer anions. While pXRD patterns of LDH and CLDH products showed changes in basal spacing as anions were intercalated in and calcined out, signifying the memory effect of the structure. The best-fit isotherm model for the LDH adsorption was the Temkin Isotherm model. After two calcination cycles, the Calcined LDH (CLDH) still exhibited efficient sorption capacity, showing good reusability.

Mg-Al-CO₃ LDH was successfully synthesized via the co-precipitation method as confirmed by FTIR and pXRD. There was adsorbent-adsorbate interaction, and the adsorbent shows good reusability.

Keywords: adsorption, calcination, textile, water contamination

MPS-13

OPTIMIZATION OF ENZYME FINISHING APPLICATION ON HIGH BLENDS OF WOVEN LYOCELL/PINEAPPLE LEAF (*Ananas comosus*) FIBER BLENDED FABRICS

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The use of indigenous Philippine fibers is gaining ground in the textiles and garment industry specifically the abundantly growing *Ananas comosus* (pineapple leaf) which is in the forefront of developing new textile materials as high-quality fibers. Serving as base materials for wearables, textiles are usually evaluated according to design, price, functionality, ease of use and wearability. Comfort is one of the bases in choosing a fabric for wearables and with fabrics from natural fibers encountering hairiness difficulties, the use of enzyme cellulase to address this issue is explored. Application through washing with controlled pH and temperature of the cellulose enzyme as finishing on different blends of lyocell/pineapple greige fabrics were accomplished. The effect of biopolishing on different high blends of fabrics were evaluated using the PNS/PTRI 165:2005 Specification for woven Philippine Tropical Fabrics for career dress apparel as an official guide. 50/50 lyocell/pineapple blend has exhibited the most satisfactory results after enzyme treatment with a pilling resistance rating of 4, breaking strength of above 500N, dimensional change rating within ±2.5% after 3 launderings and minimal fiber loss. Enzyme finishing also improved the colorfastness and dyeability of the high blended Philippine natural textile fiber blended fabrics. Fabric biopolishing by means of cellulase enzyme finishing greatly improves the overall feel and comfort that a high blended natural fiber fabric may provide. This is a more ecological approach to address the hairiness issue commonly observed in natural fiber blended fabrics making it a more viable option as a wearable textile.

Keywords: natural fiber blended fabrics, woven fabric, fabric hairiness, cellulase enzyme finishing, fabric biopolishing

POLYDOPAMINE-BASED MOLECULARLY-IMPRINTED THIN FILMS FOR ELECTROCHEMICAL SENSING OF PYOCYANIN

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Pseudomonas aeruginosa is a type of bacteria that is commonly found in the environment and can cause a variety of infections in humans, particularly in individuals with weakened immune systems. In a hospital setting, it is important to detect the presence of *P. aeruginosa* immediately because it is a highly virulent pathogen that can cause severe infections, such as pneumonia, sepsis, and urinary tract infections. Hence, early detection and rapid initiation of appropriate treatment can help to prevent the spread of the bacteria to other patients and improve outcomes for those who are infected. Current methods for detecting *P. aeruginosa* utilize microbiological techniques that take at least 2-3 days for the result to come out.

Exclusive for *P. aeruginosa* is the production of a redox-active molecule, pyocyanin. This molecule is considered as the biomarker for the gram-negative bacterium. In this study, a polydopamine-modified glassy carbon electrodes (GCE) imprinted with pyocyanin was prepared. The molecularly imprinted polydopamine (MIP) films were prepared *via* potentiodynamic electropolymerization of dopamine in GCE on a phosphate buffer–saline (pH 7.0) solution containing pyocyanin. Cyclic voltammetry was used to generate a current response towards pyocyanin by scanning the working electrode between 0 V and –0.4 V (vs. Ag/AgCl) at 50 mV·s^{-1} scan rate in PBS. The MIP-GCE showed a 13× higher current response towards pyocyanin as compared to non-imprinted polydopamine (NIP) on GCE. This is attributed to the success of the imprinting process. Moreover, this improved sensitivity is ascribed to the ability of the MIP to concentrate pyocyanin in proximity to the transduction element. The resulting MIP-GCE voltammetric sensor showed a linear range of between 10 μM to 100 μM pyocyanin (r^2 = 0.9927), with the limit of detection and limit of quantitation found to be at 6.45 μM and 21.5 μM, respectively.

The results suggest that our pyocyanin-imprinted polydopamine films on GCE is a simple and promising voltammetric sensor for pyocyanin.

Keywords: pyocyanin, molecularly imprinted polymer, polydopamine, voltammetry, *Pseudomonas aeruginosa*

MPS-15

PREPARATION OF HYBRID NI/CO OXALATE METAL-ORGANIC FRAMEWORKS VIA CONVENIENT SYNTHETIC ROUTES FOR CADMIUM AND LEAD REMOVAL

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Metal-organic frameworks (MOFs) as adsorbents offer high porosity and specific adsorbate-adsorbent interactions, hence its growing traction in development of efficient water purification systems. These highly tunable materials present opportunities to optimize trapping of heavy metal pollutants in wastewater, especially Cadmium and Lead which are hazardous even at low concentrations. Mechanical stirring and sonication are relatively simple synthetic pathways employed in the preparation of target hybrid Nickel/Cobalt (Ni/Co) oxalate MOFs in this study; and structurally confirmed by FTIR spectroscopy. Analysis of equilibrium adsorption data suggests Freundlich isotherm best models the adsorption process of the synthesized MOFs. The maximum equilibrium uptake of Cd(II) and Pb(II) obtained from AAS measurements were 2.689 mg/g and 5.074 mg/g for the adsorbents coprecipitated by mechanical stirring, 2.257 mg/g and 4.515 mg/g by sonication, respectively. Mean removal efficiency of both Cd(II) and Pb(II) was significantly higher for the MOFs obtained from stirring compared to sonication.

Keywords: metal-organic frameworks, adsorbent, cadmium, lead, mechanical stirring, sonication

MPS-16

PRODUCTION OF CELLULOSE HYDROGEL FROM NIPA
(*Nypa fruticans* Wurmb) FROND

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Cellulose hydrogel has the potential to meet the increasing demand for environment-friendly products due to its countless advantages such as low cost, nontoxicity, biodegradability, and hydrophilicity. The interest in the research and development of cellulose hydrogel has been increasing due to its flexible and wide applications. As such, this research generated baseline information on the production of cellulose hydrogel from nipa frond biomass, specifically, evaluating the composition, morphological properties, solubility, and the capability of isolated nipa α-cellulose (iNαC) as a raw material for cellulose-based hydrogels. Preliminary data suggest that biomass treated with 10% NaOH can be used in the isolation and purification process and thus, can be treated with a lower concentration of NaOH in the initial soda treatment. The results of the experiment indicate that the purity of the iNαC from acid-base hydrolysis is 94.58%-99.48%. The morphological properties of iNαC were also observed through SEM analysis. The cellulose shows the normal macro fibrils' shape and size distribution. However, the iNαC also shows well-distributed microfibrils of cellulose arranged in orthogonal layers that are parallel to each other because of the acid hydrolysis treatment in the isolation and purification methods. Furthermore, the photomicrographs of iNαC are almost free of trenches, and cracks. To widen the applications for hydrogel production, the iNαC was subjected to dissolution. Solubility (%) reveals that iNαC from 10% NaOH is an ideal pretreatment process for a lower cost and environment-friendly production of cellulose solution, hence decreasing chemical waste. Different crosslinkers were mixed with cellulose solution for the production of hydrogels. The MBA gels that were produced gave an almost watery consistency. On the other hand, the hydrogels from sodium alginate gave smooth viscous solutions. While the hydrogels from the carbomer polymer especially with αCP100 and CCP100 showed thick viscous solutions that don't easily flow. In the comparative relative viscosity of the hydrogels, the control (CCP100) showed the highest viscosity which yielded 20000 mPa·s followed by the αCP100 (19623.22 mPa·s). The data shows that cellulose-based hydrogels were more viscous than water-based hydrogels, therefore increasing the integrity of the produced hydrogels. The turbidity of the chemically crosslinked hydrogels was also analyzed along with the viscosity. As expected, CCP100 showed the highest turbidity amounting to 10.692 NTU, it was statistically incomparable to the turbidity of αCP100 amounting to 8.217 NTU, and to the other hydrogels from different crosslinkers. Thus, this study shows that the iNαC can be further processed to produce a cellulose-based hydrogel through chemical crosslinking and can be used as a good blank template for many applications.

Keywords: hydrogel, chemical crosslinking, biomass, nipa frond

RICE HUSK-BASED CELLULOSE-METAL ORGANIC FRAMEWORK (CELLOMOF) COMPOSITES AS POTENTIAL ADSORBENTS FOR NUCLEAR WASTE REMEDIATION

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Rice is the most essential staple food, with its cultivation generating tons of biomass wastes, including straws and husks, resulting in serious environmental and health problems. Therefore, strategies to sustainably upcycle these biomass wastes are of great research interest. This study focused on the fabrication of a cellulose-metal organic framework (celloMOF) composite using rice husk-based cellulose and a copper-benzene dicarboxylic acid (Cu-BDC) MOF. Moreover, their performance as adsorbents for removing simulated cobalt radionuclide was also assessed. Cellulose fibers were extracted through the conventional alkali treatment and bleaching methods, while synthesis of MOF was done through one-pot solvothermal synthesis. FTIR and pXRD assessment of chemical and crystal structure confirmed the extraction of cellulose, as well as the subsequent synthesis of Cu-BDC and celloMOF. Adsorption data were obtained through atomic absorption spectrometry and adsorption isotherm fitting revealed and investigated through quantification of adsorption capacity and isotherm model fitting. Comparative adsorption studies have found that the celloMOF has a higher maximum adsorption capacity of 2.756 E-05 mol/g than Cu-BDC. Findings from the study strongly proved that celloMOF from rice husk cellulose can be utilized as a potential adsorbent material for radionuclide removal from nuclear waste.

Keywords: rice husks, cellulose, adsorption, radionuclide waste, upcycling

MPS-18

SYNTHESIS AND CHARACTERIZATION OF COPPER-IRON OXIDE FOR THE PHOTODEGRADATION OF FUCHSINE

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Improper processing and disposal of contaminated industrial wastes largely contribute to environmental pollution. The prevalence of contaminants, such as dyes, in wastewater calls for innovative methods of remediation. Metal oxide catalyzed photodegradation takes advantage of the dye's ability to absorb photons. It can provide a fast method that could degrade the dye into carbon dioxide and water. In this study, copper-iron (Cu-Fe) oxides with varying copper:iron molar ratios were synthesized via the ignition of Cu^{2+} and Fe^{3+} oxalate precipitates. The successful formation of the Cu-Fe oxalates was confirmed using FTIR analysis. The Cu-Fe oxide catalysts were combined with hydrogen peroxide and fuchsine solution, then subjected to UV radiation. Photodegradation studies showed that the degradation of fuchsine was hastened by the addition of the Cu-Fe oxides. The 1:1 Cu-Fe oxide ratio catalyzed the degradation more effectively than the 2:1 and 1:2 ratios, with rate constants of 0.184 min^{-1}, 0.0253 M^{-1} min^{-1}, and 0.0264 min^{-1}, respectively.

keywords: fuchsine, uv photodegradation, metal oxide catalysis, copper-iron oxide

MPS-19

SYNTHESIS OF MnO$_2$ NANOPARTICLES USING *Zea mays* HUSK EXTRACT FOR DEGRADATION OF BRILLIANT BLUE DYE

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The synthesis of nanoparticles through physical and chemical processes are often hazardous to the environment. A greener alternative is the use of plant extracts, preferably agro wastes such as husks, that serve as reducing, stabilizing, and capping agents. Meanwhile, organic dyes also present environmental concerns due to components that may be toxic and carcinogenic. In this study, MnO$_2$ nanoparticles synthesized from KMnO$_4$ and corn husk extract were investigated for their physical and spectral properties via UV-Vis spectroscopy and x-ray diffraction techniques. The kinetics of the photocatalytic degradation of brilliant blue dye by MnO$_2$ nanoparticles was also observed. From the UV-Vis spectrum, a strong absorption peak at 375 nm was observed and a band gap of 2.07 eV was obtained. The addition of MnO$_2$ nanoparticles degraded up to 3x more dye as compared to the negative control, and increased the rate constant for the second-order reactions. However, the absence of visible light did not seem to affect the rate of degradation with MnO$_2$, implying another degradation route besides the photocatalytic route. The results of this study indicate Zea mays husk extract an effective reducing agent for the synthesis of MnO$_2$ nanoparticles that are capable of degrading brilliant blue dye.

Keywords: MnO$_2$ nanoparticles, *Zea mays*, brilliant blue, x-ray diffraction, dye degradation

THE EFFECT OF pH ON THE PHOTOCATALYTIC ACTIVITY OF AMINOPHENOL-FUNCTIONALIZED ZnO NANOPARTICLES

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Zinc oxide is a cheap and effective catalyst for the photodegradation of harmful organic pollutants, such as synthetic dyes, that significantly contribute to water pollution. However, the surface properties and frequent photo corrosion and dissolution of ZnO at various pH tend to reduce its photocatalytic activity. Hence, its surface is often modified to optimize its properties and applications. In this study, surface functionalization using 2-aminophenol was performed in pristine ZnO nanoparticles to enhance dye adsorption onto its surface, depending on the charge of 2-AP at certain pH values (4, 7, 13). The experimental band gap and XRD parameters for pristine ZnO yielded small errors when compared to the expected results, which suggested successful synthesis of the desired NPs. Besides, the band gap of AP-ZnO NPs showed marginal difference to the experimental pristine ZnO that implied that its electronic properties were preserved despite the addition of functional groups on its surface. Meanwhile, the success of functionalization was solidified through the peaks seen in the IR spectra of the material, which revealed the M-O stretch from ZnO, and the N-H and O-H stretches from the amine and hydroxyl groups of 2-AP. The colloidal stability and particle size distribution of the NPs were also obtained using Zeta potential and Dynamic Light Scattering measurements. Brilliant blue G, an anionic staining dye, was then photodegraded at the mentioned pH values using the catalyst forms under visible light following the first-order kinetics. A significant increase in photocatalytic activity was observed in AP-ZnO at pH = 4 when compared with pristine ZnO, due to the maximum electrostatic interactions between 2-AP and the dye which led to better adsorption. At pH = 7, better performance was seen in pristine ZnO over AP-ZnO which may be due to the neutral surface charge of 2-AP at this point. Lastly, at pH = 13 where the photo-activity was relatively small, the AP-ZnO NPs were found to have higher activity than the pristine form. This is since at higher pH, the dissolution of pristine ZnO is favored; in contrast with AP-ZnO that retained its structure due to the protection offered by 2-AP against the extreme environment. All in all, the results suggested that ZnO is an easily tunable material to improve its properties, the catalytic activity of functionalized-ZnO NPs depends on the properties of the groups being attached on its surface, and the effect of pH is noteworthy, and it warrants further studies to completely realize its role in photodegradation process.

Keywords: zinc oxide, aminophenol, surface functionalization, pH effects, photocatalytic activity

UV-DEGRADATION OF BRILLIANT GREEN WITH ZEOLITE-IMMOBILIZED FeO/Fe$_2$O$_3$/CuO

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One of the by-products of economic development is the increasing number of organic pollutants that majorly affect bodies of water. These organic pollutants like dyes degrade naturally but at a very slow rate. One of its mechanisms is photodegradation which can be sped up by adding photocatalysts such as Fenton's reagent. Fenton's chemistry refers to the reaction between ferrous ions and hydrogen peroxide to produce hydroxyl radicals which can degrade organic compounds. Fenton's reaction is commonly used in wastewater treatment however it is only active in acidic pH and it produces iron sludge, more importantly, it is dependent on the constant addition of hydrogen peroxide. Coupling iron with copper and immobilizing it were found to increase the working pH of the Fenton's reaction, increase the rate of photodegradation, and improve its recoverability. The current study aims to prepare iron and copper oxide (FeCuO) particles immobilized using zeolites and to determine its photocatalytic activity in the UV-degradation of brilliant green. Fe-Cu oxalate loaded zeolites were initially synthesized through oxalate coprecipitation. The product was then burned at 700°C for 4 hours and the dark brown product was collected. FTIR analysis of the coprecipitation products and the combustion products show completed preparation of the FeCuO-loaded zeolites. The identity of the product was also confirmed through XRD analysis. The UV degradation of brilliant green by the FeCuO-loaded zeolite was analyzed over 60 minutes with the concentration of the dye taken in 10-minute intervals. It was found that the FeCuO-loaded zeolites caused 19.1% degradation, 1.21 times more degradation compared to the trial with no catalyst present. These results indicate that the current study was successful in the production of a Fenton's chemistry based photocatalyst.

Keywords: Fenton's reagent, organic dye, zeolite, photodegradation, photocatalyst

MPS-22

VISIBLE-LIGHT-MEDIATED SYNTHESIS OF DIBENZOSELENOPHENE

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Organoselenium compounds are frequently found in numerous natural products and bioactive compounds. However, the synthesis of dibenzoselenophene has several limitations because they require toxic, sensitive catalysts or reagents as well as sensitive, or harsh reaction conditions. A mild approach for the synthesis of selenaheterocycles starting from aryl diazonium salts was developed. The desired selenaheterocycles were obtained in moderate to high yields (46%–90%). The one-pot process and subsequent visiblelight-mediated silver-catalyzed cyclization enabled the synthesis of selenaheterocycles in the absence of a photocatalyst. The reactions were carried out under mild conditions without the use of toxic or sensitive reagents.

Keywords: cyclization; radical reactions; selenium; silver catalysis; visible light

CHARACTERIZING THE JUNIOR HIGH SCHOOL MATHEMATICS CURRICULUM OF THE PHILIPPINES: A NETWORK APPROACH

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Curriculum review is as important as its implementation to ensure that it is tailor-fitted to the needs of the learners. Network analysis has been used in describing complex systems including systems in the field of education. This research aims to show how network analysis can help describe complex systems like the Junior High School Mathematics Curriculum of the Philippines. A directed network was constructed using the learning competencies in the Junior High School Mathematics Curriculum Guide of the Philippines. The nodes represent the learning competencies while the edges were formed by creating links between learning competencies and their prerequisites. Learning competencies were classified by grade level (7,8,9, and 10) and by domain (Geometry, Measurements, Numbers and Number Sense, and Patterns and Algebra). Network characteristics were used to characterize the mathematics curriculum guide as a whole and the relation between the learning competencies. As a result, a graph with 219 nodes and 1022 edges were created. Grade 7 (64 nodes) and Grade 9 (48 nodes) have the most and least nodes, respectively. Patterns and Algebra (104 nodes) have the most nodes, whereas Measurements have the fewest (5 nodes). Overall, the node with the highest outdegree (104) is "performs fundamental operations on integers." This suggests that 104 more competencies are dependent on performing fundamental operations on integers, or this competency is the most frequently recalled. Additionally, the number of connected components is one implying that no learning competency is isolated. Thus, network analysis can be used as an evidence-based method to review the mathematics curriculum used in the Philippines.

Keywords: mathematics curriculum, network analysis, learning competencies, prerequisite, junior high school

TREND ANALYSIS OF COVID-19 IN SELECTED PROVINCES OF THE PHILIPPINES USING SOBOLEV POLYNOMIALS

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Trend analysis of daily cases of COVID-19 helps determine the extent of transmission of the disease and the rate at which the infection spreads across individuals. The 7-day moving average is a common tool in trend analysis of COVID-19. However, unless the window size of the moving average is increased, the smoothed data will still reflect fluctuations, which can make trend analysis challenging.

In this paper, we apply an alternative smoothing technique using Sobolev polynomials to analyze trends in COVID-19. This method, which is a generalization of the Whittaker-Henderson method commonly applied in actuarial studies, produces a polynomial that represents the trend in data. Because the trend is represented by a polynomial, it is guaranteed to be smooth, thus allowing the application of techniques to find extreme points of the trend and characterize the concavity of the trend over a given period. Moreover, the polynomial function also allows one to generate quick short-term forecast or fill-in missing data points that are consistent with the general trend exhibited by data. We use this method to analyze COVID-19 data for selected provinces in the Philippines obtained from the DOH data drop by evaluating the trend and generating short-term forecast and insights about the spread of the disease that can be used in public health policy-making.

Keywords: Covid-19, Sobolev polynomials, Whittaker-Henderson method

SOCIAL SCIENCES

SSD-01

BEFORE AND AFTER THE SHIFT: DEVELOPED KNOWLEDGE, SKILLS, AND ATTITUDE (KSA) OF EDUCATORS TOWARDS TRAININGS ON VOLCANO, EARTHQUAKE, AND TSUNAMI HAZARDS AND IMPACTS

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The Department of Science and Technology – Philippine Institute of Volcanology and Seismology (DOST-PHIVOLCS) thru its Capacity-Building arm under the Geologic Disaster Awareness and Preparedness Division (GDAPD) conducted various trainings tailored to the Department of Education (DepEd) curriculum for educators to further build their knowledge, enhance their skills, and help develop the right attitude towards volcano, earthquake, and tsunami hazards and impacts. During the COVID-19 pandemic in 2020, the capacity development approach adapted to the demands of time and shifted from face-to-face trainings to blended e-learning. In this research, various target participants' Knowledge, Skills, and Attitude (KSA) documented from 2019 to 2021 were thematically assessed to gain more perspective on the course of their learning and application before and after the training shift. Results showed that there was a consistent enhancement in the participants' knowledge on these specific geologic hazards and impacts; a notable augmentation of their skills in school-based disaster risk reduction (DRR) and management, and; a perceivable sense of readiness during emergencies as well as amenability to more DRR initiatives that would help them protect their stakeholders and collaborate their learnings within their vulnerable communities. In order to arrive at more progressive findings and encourage individual motivation to adapt and be more involved during critical times, high-engagement activities and scenario-based workshops were deemed necessary in the blended mode of e-learning such as with the face-to-face trainings.

Keywords: Knowledge, Skills, and Attitude (KSA), capacity development, blended e-learning, disaster risk reduction (DRR)

SSD-02

COGNITIVE SKILLS INEQUALITY AND ACADEMIC ACHIEVEMENT IN THE PHILIPPINES, VIETNAM, AND MALAYSIA: EVIDENCE FROM PISA 2018

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In this paper, we aim to rank the socio-economic circumstances that contribute to the most unfair inequalities from the existing achievement gaps in the Philippines, Vietnam, and Malaysia. Roemer's theory suggests that inequality compensation focuses only on unfair inequality which is due to circumstances not controlled by the individual. Fair inequality which is due to controllable volition must not be compensated for. We focus on achievement inequality in reading because it is the core cognitive skill needed in learning higher technical skills in post-secondary education. Unique to this study is its consideration of ability, a major determinant of academic achievement when decomposing unfair inequalities. Hence, achievement inequality is based on differences in circumstances, individual volition and ability.

Using the Programme for International Student Assessment (PISA) 2018, we factor in student ability through the reading metacognition variables. With the generalized entropy method, we rank the socioeconomic circumstances (parental education, gender, institution type, and number of books at home) based on its contribution to unfair inequality and recommend priority circumstances for policy compensation. We use these unfair circumstances since they exacerbate educational inequality in the current literature.

Our findings show that in the Philippines, Vietnam, and Malaysia, all three variables approximating parents' education ranked high in terms of unfair inequality. Mother's education posed the highest contribution to inequality index in the Philippines at 18.98 percent. Meanwhile, the number of books at home is the highest contributor to unfair inequality in both Vietnam and Malaysia at 11.22 and 9.37 percent, respectively. Lastly, institution type is the lowest contributor to unfair inequality in both Vietnam and Malaysia at 0.85 and 1.51 percent, respectively, while gender is the lowest for the Philippines at 2.57 percent.

It is notable that the Philippines recorded the highest unfair inequality index for all circumstances, except gender, where it ranked last. Filipino students therefore experience the most unfair inequality in education hence the need for better inequality compensation for disadvantaged students. Malaysia consistently scored the lowest in all circumstances, except gender and institution type. Lastly, Vietnam is always in the middle, except for institution type where it has the lowest unfair inequality.

Thus, policy recommendations to minimize educational inequality should focus on identifying and compensating students whose parents' have lower levels of education and whose number of books at home are low in all three countries. If not addressed, these gaps will widen over time as relevant skills and knowledge are not sufficiently mastered, making it more difficult for disadvantaged students to acquire highly demanded skills needed in the labor force.

Keywords: achievement gap, education and inequality, equality of opportunity

CYBERSECURITY AWARENESS OF THE FILIPINO YOUTH

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The number of people using the internet today is fast growing. It has developed into an essential tool and informational resource for many and a platform where users can freely express themselves amid its virtual expanse. However, online scams and online libel are just a few examples of the cybersecurity hazards that come along with the benefits that the internet offers. In addition, one of the vulnerable populations who are exposed to cybersecurity threats are children and the youth. In response to the seriousness of these cybersecurity issues, this research was conducted to understand the level of awareness of the youth regarding cybersecurity to come up with recommendations to strengthen cybersecurity awareness of the youth.   After all, the lack of cybersecurity knowledge is a threat as well. This research used the mixed-method approach and the descriptive research design. A total of 811 Filipino youth from the province of Benguet, Cavite, Laguna, and Cebu, were randomly selected as respondents to this study. Findings showed that the respondents were "highly aware" of cybersecurity in terms of authentication basics. However, the respondents were "slightly aware" of cybersecurity, considering the privacy of data and information and threats on digital platforms. Moreover, these results highlighted areas in cybersecurity where the youth must be more informed and knowledgeable. In addition, this research showed the relevance of providing seminars, courses, and training focusing on the awareness of the youth to keep them guided on how to manage and enhance their skills in monitoring and identifying possible threats on cybercrimes. Consequently, the findings showed implications for knowledge-building and suggestions to enhance the practices, programs, policies, and advocacies for cybersecurity awareness and measures.

Keywords: cybersecurity awareness, Filipino youth, cybersecurity training

SSD-04

DISASTER JOURNALISM: THE 2020 TAAL VOLCANO ERUPTION PRINT MEDIA COVERAGE

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The media undoubtedly became a primary source of information for the public during the 2020 Taal Volcano Eruption. However, before this study, the quality of media communication about Taal remained unknown. Understanding the content and manner of communication is important because uncertain events like volcanic eruptions are prone to risk amplification which can lead to inappropriate societal actions. Hence, this study analyzed the media coverage of the 2020 Taal Volcano Eruption vis-à-vis the framework of disaster journalism and using the lenses of the Framing Theory and Social Amplification of Risk Theory. A total of 384 stories from 6 nationally-circulated newspapers were sampled. It was determined that the frames used by the media largely functioned as a problem identifier, where 71% of the stories framed the event as a matter of human interest. Potentials for risk amplification were also noted in the use of dramatization, personification, and projection of future risks. However, amplification was balanced by attenuating signals such as the downplaying of economic impacts and the provision of disclaimers regarding conflicts in governance. On the other hand, due to the limited use of cause diagnosis frames (7%), the volcanic risk was not well-discussed. Numerical uncertainty statements were also missing in the coverage although some stories used verbal, albeit vague, uncertainty statements. Furthermore, the solutions presented in the media were dominated by disaster response actions (26%). Whereas, disaster journalism gives importance to the other disaster risk reduction and management thematic pillars such as preparedness, prevention and mitigation, and recovery and rehabilitation. In conclusion, while the media was able to provide useful information during the eruptive phase of Taal Volcano in 2020, the coverage fell short of holistic disaster journalism.

Keywords: risk communication, communicating uncertainty, disaster journalism, risk amplification

SSD-05

EDUCATORS' PERSPECTIVES ON GEOLOGIC DISASTER RISK REDUCTION IN SCHOOLS

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The Sendai Framework for Disaster Risk Reduction (DRR) highlights the incorporation of disaster risk knowledge in formal and non-formal education. Furthermore, the Department of Education's framework aims to institutionalize DRR in schools through safe learning facilities, school disaster management, and DRRM in education. However, it remains unknown how these frameworks are implemented on the ground. Specifically, strategies employed by educators to realize these frameworks are understudied.

This research therefore analyzed the content of 232 action plans prepared by senior high school teachers, junior high school teachers, school DRR focal persons, and education program specialists during the implementation of the DOST-PHIVOLCS TEACH DRR (Training Educators and Administrators for a Collective Headway towards Disaster Risk Reduction) trainings in 2022. The content analysis focused on the strategies being used by educators in integrating geologic DRR in schools. Data were coded accordingly and the frequency counts were determined. An action plan can contain more than one strategy or theme; hence, the counts are non-exclusive.

Results revealed the prevalence of co-curricular and extra-curricular activities as strategies for implementing geologic DRR in schools. Specifically, 168 (72%) action plans cited capacity building activities such as seminars, trainings, orientations, and forums for students. This strategy also includes the echo sessions for teachers through their Learning Action Cell (LAC). Moreover, 60 (26%) mentioned the conduct of earthquake and tsunami drills. Such result is not surprising because of the Nationwide Simultaneous Earthquake Drill that is mandatory in public schools. Additionally, 29 (12%) cited hazard identification, assessment, and mapping in schools. To do this, 10 (4%) action plans cited using DOST-PHIVOLCS information tools such as HazardHunterPH and How Safe is My House. Other strategies include contingency planning (12, 5%) and evacuation planning (10, 4%) which are central to a school's disaster preparedness. Other action plans also described how geologic DRR can be advocated beyond the school premises by engaging the students' families and respective communities (13, 6%).

On the other hand, only 31 (13%) of the action plans mentioned lesson integration as a method of implementing geologic DRR in schools. Therefore, there is a need to review the effectiveness of how geologic DRR is integrated into the basic education curriculum. Furthermore, with the high preference for co-curricular and extra-curricular activities on DRR, these should also be carefully planned in harmony with academic activities.

keywords: school-based disaster risk reduction, disaster curriculum, disaster education

EXPLORING THE RISK AND PROTECTIVE FACTORS OF FILIPINO ADOLESCENTS' PSYCHOLOGICAL WELL-BEING

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Adolescence is a developmental stage in which a great number of important changes occur (Erikson, 1968). As the adolescent transitions from childhood to adulthood, there are psychological, physical, and social changes that must be taken into account. It is expected that these changes will have an impact on the adolescents' well-being during this developmental stage, which could result in a range of problem behaviors and poor adjustment outcomes. It is important to understand ways in which adolescents' psychological well-being can be improved given that resiliency, mental health, and other protective factors are predicted by high psychological well-being (Casas, 2011). In this connection, this study determines whether emotional autonomy and identity commitment (developmental tasks) have a significant effect on adolescents' psychological well-being.

Correlational research was utilized in this study. A total of 500 middle and late adolescents with an age range from 15 to 19 years were purposively selected to participate. Parent consent was secured first among minor participants. To examine the unique contribution of these two developmental tasks in the explanation of psychological well-being, a hierarchical regression analysis was performed. Variables that explain psychological well-being were entered in two steps. In step 1, psychological well-being was the dependent variable and emotional autonomy was the independent variable. In step 2, identity commitment was entered into the step 1 equation. Results showed that emotional autonomy negatively predicts psychological well-being ($\beta = -.224$, $p = <.000$). However, adolescents whose identity commitment is high tend to have better psychological well-being. Identity commitment explains 10% of the variance in psychological well-being. This amount is unique from what emotional autonomy explains. As such, strong identity commitment serves to protect adolescents from the weakening of psychological well-being because of emotional autonomy. With this, understanding adolescents' psychological well-being and its contributing factors (risk and protective) can help clarify and define ways to better prepare adolescents for adult life (Schalkwyk & Wising, 2010).

Keywords: adolescent, psychological well-being, parental closeness, emotional autonomy, identity process

SSD-07

HAPPINESS INDEX OF FABRICATION LABORATORY EMPLOYEES IN THE PHILIPPINES: AN EXPLORATORY STUDY

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Employee happiness fuels productivity and creativity, thus innovation centers strive to keep their employees happy. They are seeking to increase employee happiness to boost corporate value. The fabrication industry is currently at the forefront of technological advancements. Fabrication Laboratories (FAB LABs), like any other industry, consider its employees as one of the essential pillars for success. The objective of this research is to measure the happiness index of FAB LAB employees and identify the underlying indicators that influence their level of happiness. The Happiness Index is a comprehensive survey instrument that assesses life satisfaction, happiness, and happiness domains such as psychological well-being, health, community, social support, education, environment, governance, and work. A framework for examining the Happiness Index for FAB LAB employees in the Philippines was developed in terms of the following domains: job inspiration, psychological well-being, working environment, health, and relationship. A total of 48 employees out of 53 in 22 FAB LABs across the country participated in the study. The Cronbach Alpha coefficient was used to evaluate instrument dependability. Descriptive statistics, correlation, and regression were applied in data analysis. The only demographic characteristic found to have significant association with overall happiness index was the years in service. Results indicate that FAB LAB employees exhibit a high level of happiness at work, and that job inspiration and health were the predictors of their Happiness Index. Though a framework that examines the happiness index, it was found out that FAB LAB employees possess a high level of happiness, which means that employees are satisfied with their work. FAB LAB Philippines employees exhibited high satisfaction on all indicators but analysis reveals that among the five indicators, working environment appeared to have no correlation with the overall happiness index of employees. Furthermore, job inspiration and health are the indicators that were identified to predict the overall happiness index of FABLAB employees.

Keywords: happiness index, fabrication laboratories, happiness index and demographics, predictors of happiness

HEALTH PROFESSIONAL STUDENT ATTITUDES TOWARD AUGMENTED REALITY APPLICATION IN TIMES OF COVID-19 PANDEMIC

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The current educational environment in a new normal generates a whole new spectrum of questions about the use of technology to improve the quality of education, especially in health allied courses. Past studies prove the advantages of using augmented reality application in education. Augmented Reality (AR) merges the real and virtual worlds, augmenting the real with computer-generated virtual objects in real time. AR has grown more accessible since it no longer requires specialized equipment and can be utilized on mobile devices. The application of augmented reality (AR) may raise student learning motivation and contribute to higher academic achievement. However, the potential of augmented reality in education remains untapped, and there is a lack of research studying student attitude through the usage of augmented reality, especially in the Philippines.

This research extends previous studies performed in other countries that looked specifically the Health Professional Student attitudes toward Augmented Reality Application during the COVID 19 Pandemic. One of the most important findings in this quantitative research was that health professional students had positive attitude about the use of Augmented Reality in their courses. Considering the students' perceptions and matching the objectives specified in the provided study, it has shown that augmented reality is relevant and reliable application. In addition, it increases students' confidence since AR assisted students in immersing themselves in complicated topics and enhanced their motivation.

Keywords: attitude, augmented reality, Health Professional Student, Covid 19

IT'S A MAN'S WORLD: RELATIONSHIP BETWEEN MASCULINITY, SOCIAL CONNECTEDNESS AND EMOTIONAL WELL-BEING AMONG MALE YOUNG ADULTS

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Transitioning into early adulthood could be tough for men, especially when it comes to building identities and establishing identities. Men frequently project a "tough" image of masculinity in order to escape the stigma of being perceived as delicate or less competent by their peers. As a result, men's mental health is heavily influenced by both the men themselves and societal concepts of masculinity. Previous research has found a negative relationship between masculinity and emotional well-being in young people (Berke et al., 2018). As a result, it is critical for study to uncover factors that mediate the link between masculinity and emotional well-being.

Thus, to address the research problem regarding the mediating role of social Connectedness on the relationship between the meaning of adolescent masculinity and emotional well-being, a mediation analysis was conducted using the Hayes Process analysis for mediation. The said analysis followed Model 4), which suits the simple mediation. The results revealed that there is a significant positive indirect effect of the meaning of young adult masculinity on emotional well-being (ab = .159, 95% CI [.0824 - .2452]). This suggests the meaning of their masculinity predicts social Connectedness, which in turn, significantly predicts emotional well-being. Then, in the same analysis, Path c' or the direct effect of the meaning of young adult well-being on emotional well-being in presence of the mediator was also found significant (β = .097, p = .0168). Hence, social Connectedness partially mediated the relationship between the meaning of young adult masculinity and emotional well-being.

Keywords: masculinity, social connectedness, emotional well-being, young adult, peers

SSD-10

ECOSYSTEM SERVICES IMPACTS OF MANGROVE REHABILITATION TO THE LOCAL COMMUNITIES IN BARANGAY PAGATPATAN, BUTUAN CITY

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The mangrove ecosystem can provide various services categorized into provisioning, regulating and cultural. This study aimed to determine the various ecosystem services attributed to mangrove rehabilitation in Barangay Pagatpatan as perceived by local communities. Mangrove rehabilitation site in Barangay Pagatpatan was in the abandoned and underutilized fishpond replanted with *Rhizophora* spp. Both the direct and indirect beneficiaries were considered in determining the ecosystem services attributed to the mangrove rehabilitation project of the Caraga State University. The direct beneficiary refers to the fishermen and households who collect goods in the mangrove area, while indirect beneficiaries are consumers of goods and services collected/offered by the mangrove ecosystem. Focus Group Discussion and household interviews were conducted to generate information from the beneficiaries. In addition, land cover changes from 2014, 2018 and 2021 in Barangay Pagatpatan were analyzed to determine the mangrove cover changes resulting from the mangrove rehabilitation project. Results of the study shows that the income and fish harvest of the locals in Pagatpatan remain constant, but other marine species bring economic benefits. The resources that those direct beneficiaries obtain from the mangrove ecosystem are commonly mangrove clams, gastropods, and assorted fishes. Furthermore, indirect beneficiaries' purchases those top resources obtained by the fishers from the wetland. This is a good indication that the mangrove wetland in Pagatpatan provides much ecosystem services to the local communities. Rehabilitating mangroves in Pagatpatan improves the habitat for marine life and reduces erosion on banks while protecting against floods and storms. The mangrove rehabilitation in Pagatpatan also increased the cultural services such as serving as a recreation area. The construction of a boardwalk along the mangrove rehabilitation site which is now a fully grown mangrove have provided the local communities recreational facilities. In general, environmental enforcement has generally increased, which has led to less reclamation and conversion of the mangrove wetland. This may be due to the strong support of the Local Government Unit of Butuan City to develop Pagatpatan Wetlands to be the site for ecotourism as well as for scientific and cultural studies and community development. However, there are issues of illegal occupancy of some makeshift households in the area. Moreover, a positive increase of mangrove cover in Pagatpatan based on land cover change analysis can be attributed to the mangrove rehabilitation project implemented in 2013. These findings collaborate with the perception of the local community that rapid reclamation and conversion of mangrove forest decreases which contributed to the increase of mangrove cover.

Keywords: ecosystem services, mangrove rehabilitation, Barangay Pagatpatan

SSD-11

PITIK SA NEW NORMAL: LIVED EXPERIENCES OF STUDENTS DURING THE POST-PANDEMIC TRANSITION OF FACE-TO-FACE LEARNING

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This phenomenological research aimed to describe the lived experiences and coping strategies of students during the post-pandemic transition of face-to-face learning. It utilized semi-structured interviews in gathering qualitative data among the selected BSED sciences students through purposive sampling technique. The collected data were analyzed and interpreted utilizing the Colaizzi's descriptive phenomenological method.

The findings of this study revealed that when classes are shifted back to face-to-face learning, most students learned more subject content; however the students took a long time to process information taught in class. Students also experienced being able to know genuine friends, meet other learners face-to-face and reach out a person easily. Furthermore, students also struggled in attending an online class immediately after having in-person classes. Aside from this, learners also felt academically overwhelmed as a result of procrastination. When it comes to dealing with the post-pandemic transition of face-to-face learning, most students practiced planning ahead of time, embracing a positive mindset and taking a short break when doing school work.

This study recommends that students may study the lessons in advance, know one's own learning style and may practice the habit of proper time management. For students to become active learners, different teaching strategies may also be considered by teachers.

Keywords: lived experiences, post-pandemic transition, face-to-face learning, coping strategies

SSD-12

SNACKING PATTERN OF SCHOOL-AGE FILIPINO CHILDREN AND ITS CONTRIBUTION TO THEIR TOTAL ENERGY INTAKE

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Snacking can be defined as eating outside the three main meals in a day, regardless of the amount or type of foods consumed. Snacking patterns vary between developing and developed countries and among nations globally. This study utilized the results of the Philippine Expanded National Nutrition Surveys conducted in 2018 and 2019. A total of 30,414 children, ages 6-12 years old, participated in the surveys. Results revealed that around 69% of school-age Filipino children consume snacks. Bread, crackers, biscuits and other bakery products were the top-most snack foods consumed by children (36.1%), followed by pastries and cookies (e.g. cakes, donuts, churros, and pudding) at 35.3%, while sugar-sweetened beverages were consumed by 21.6%. Mean energy provided by snacking was 297 kcal in children 6-9 years old, and 316 kcal in children 10-12 years old, which contributed 25.1% and 21.7% to their total energy intake, respectively. Mean energy intake of children who were consuming snacks was 1186 kcal for 6-9 years old, and 1460 kcal for 10-12 years old. Children who consume snacks met more than 70% of their daily recommended energy intake while those who do not consume snacks were way below the requirements (<60%). In conclusion, snacking is common among school-age Filipino children contributing to about one-fourth of their total energy intake. Although snacking provides additional energy to meet the daily requirement for calories, snack foods must be nutritious as well. Snacking patterns of Filipino toddlers and adolescents should also be explored to provide a holistic view of the snacking patterns of Filipino children and substantiate a recommendation for healthier snack options for them.

Keywords: Filipino school-age children, energy, nutrition, snacking, survey

STUDENTS' ATTITUDE AND CRITICAL THINKING SKILLS TOWARDS COMPUTER-ASSISTED INSTRUCTION IN SCIENCE TEACHING

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The study generally aimed to investigated the level of attitude and critical thinking skills of the students exposed to Computer-Assisted Instruction (CAI). A validated and adapted survey questionnaires were utilized in gathering data among the Grade 10 junior high school science students of Banlag Intregrated School wherein total enumeration sampling technique was used in determining the participants of the study. The researchers employed descriptive-correlational research design in carrying out the investigation and quantitative data were analyzed and interpreted using descriptive statistics and Pearson-R Correlation.

Results of the study revealed that the students have a moderately positive attitude in science with the use of CAI. Furthermore, the students have moderately high critical thinking skills on the following constructs: engagement, cognitive maturity, and innovativeness. Likewise, there is a highly significant correlation existed between the students' attitude and critical thinking skills when students are exposed to CAI.

Based on the findings of the study, it is recommended that educators may consider the use of different CAI strategies in teaching science and other related disciplines since the current investigation found out that it develops students' critical thinking skills and promotes positive attitudes towards the subject.

Keywords: attitude, critical thinking skills, computer assisted instruction, science teaching

TEACHERS' 21ST CENTURY TECHNOLOGICAL PEDAGOGICAL AND CONTENT KNOWLEDGE (TPACK-21) AND DEMOGRAPHIC VARIABLES ON THEIR LEVEL OF TECHNOSTRESS IN THE POST-PANDEMIC EDUCATIONAL ENVIRONMENT

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This study investigated the relationship between technostress, 21st century Technological Pedagogical and Content Knowledge (TPACK-21), and demographic variables among high school teachers in the southern districts of the Department of Education- Province of Bukidnon, Mindanao, Philippines.

The statistical tools used in treating the data for analysis were the descriptive statistics, Pearson Product-moment coefficient, and the Multiple linear regression.

The results of the study revealed an overall mean of teachers' technostress is 2.89 which corresponds to "moderately affected by stress". The study further revealed that the greatest percentage (45.60 %) out of the total of one hundred sixty-nine (169) participants was within the 30-39 years old. On the part of gender, majority of them are female constituting 97 participants (57.40 %) whereas the remaining 42.60 % are male. A "High level of knowledge" in the overall TPACK-21 efficacy among the high school teachers has been very evident in the study as shown in the grand mean of 3.97.

The data exposed high significant relationship with 21st Century Technological Pedagogical and Content Knowledge (TPACK-21) r = -0.58 (p<0.038); Technological Knowledge (TK-21) r = -0.10 (p<0.043); Pedagogical Knowledge (PK – 21) r = 0.82 (p<0.025); and Technological Pedagogical Knowledge r = -0.78 (p<0.047). It is also highly significant in terms of Age r = -0.896 (p<0.028). Since most of the correlations are highly and negatively significant (with an exception to the Pedagogical Knowledge), the study indicated that as the TPACK-21 variables increase, the level of technostress decreases.

Pedagogical Content Knowledge, Technological Content Knowledge, and the Technological Pedagogical and Content Knowledge were the three (3) predictor variables that affect teachers' technostress. Given that the overall influence of the three variables on the teachers' technostress was 69% ($R2 = 0.069$), this study provides a window for the Department of Education administrators to revisit and examine the implementation and training of teachers to boost their teaching efficacy based on the status on technostress as related to their 21st Century Technological Pedagogical and Content Knowledge.

Keywords: teachers' technostress, TPACK-21, demographic variables

THE LIVED EXPERIENCES OF MOTHERS LIVING WITH HUMAN IMMUNODEFICIENCY VIRUS (MLHIV): AN INTERPRETATIVE PHENOMENOLOGICAL ANALYSIS

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In 2019 (UNAIDS), globally there are nearly 40 million people living with HIV, and more than half are women. In the Philippines, there are a total of 69,512 diagnosed HIV cases from January 1984 to July 2019 as reported by the HIV/AIDS and ART Registry of the Philippines (HARP). Of these, 6% (4, 339) were women. Although the percentage of infected women in the country is lesser compared with men, women particularly mothers are more likely to bear the double burden of being infected and having to care for children infected through vertical transmission of HIV. For many women, becoming a mother gives their lives significance. However, childbearing and childrearing can be challenging because HIV affects many facets of daily life (Leyva-Moral, Piscoya-Angeles, Edwards, & Palmieri, 2017). Mothers living with HIV have additional difficulties, especially in light of the negative effects of poverty, gender inequality, and stigma. The purpose of this study was to investigate the actual lived experiences of mothers who received an HIV diagnosis. The goal was to comprehend how having HIV affects parenting at various stages of the mothering journey in an era with increased access to antiretroviral therapy. It is critical that medical and mental health professionals comprehend and address the worries that women have when they receive an HIV diagnosis, as well as how they manage motherhood while benefiting from improvements in maternal health brought on by access to ART. Additionally, knowing how HIV diagnoses feel at various stages of motherhood may help caretakers be more attentive to mothers both before and after the diagnosis.

This qualitative study used interpretative phenomenological analysis to explore and understand the lived experiences of mothers living with HIV. A total of six (6) MLHIV with ages ranging from 30-50 were recruited and individually interviewed. All interviews were conducted in the local language to allow the participants to express themselves freely in their own language. To foster a dynamic exchange between the researcher and the participant, follow-up questions were asked to elicit meaning from the responses given. Five main themes emerged from the analysis of the interviews, namely the (1) diagnosis and response, (2) mothering experiences, (2) mothering practices, (4) positive feelings about motherhood, and (5) creating support networks.

Keywords: mothers living with HIV, interpretative phenomenological analysis

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